

# DISTRO

080913 #102

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**HTC SIZES  
DOWN ITS  
FLAGSHIP ONE**

**MOTO X MAKES  
A PLAY FOR THE  
EVERYMAN**

**SAMSUNG ADDS  
ANOTHER TAB  
TO THE PILE**

## CRASH COURSE

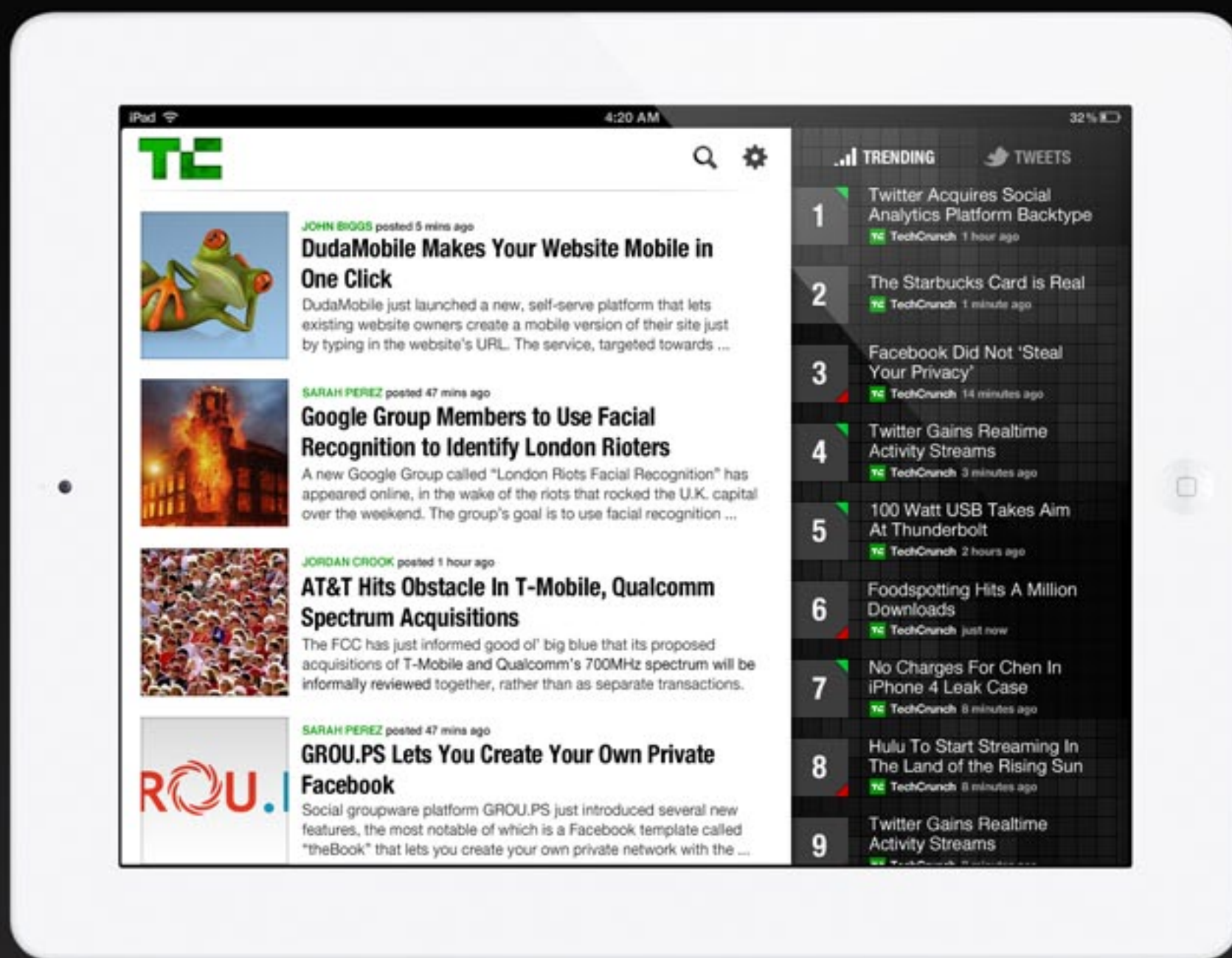
**DEMYSTIFYING THE  
SCIENCE BEHIND  
PARTICLE ACCELERATORS**





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DISTRO

08.09.13

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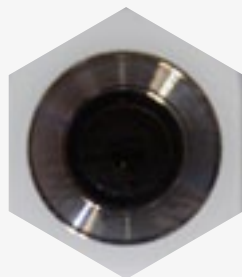
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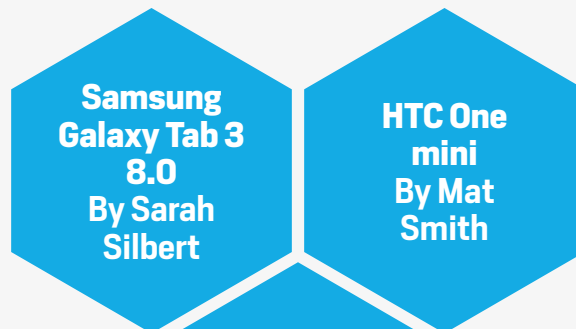


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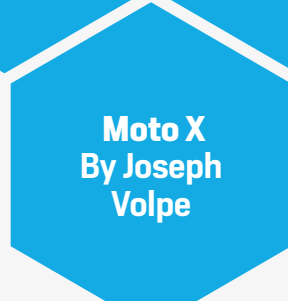
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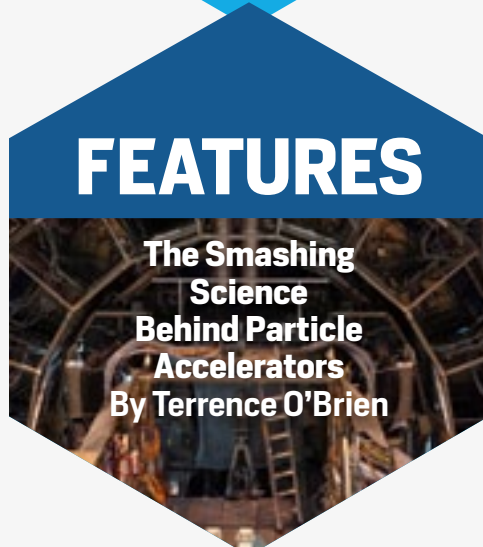


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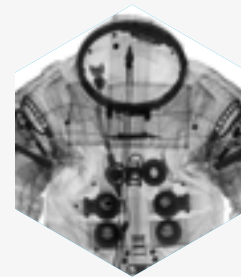
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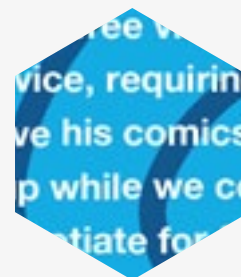
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Photo by Joseph Volpe for Distro



# WILL LG GET LUCKY WITH THE G2?

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EDITOR'S  
LETTER



**IT WASN'T LONG AGO** that the electronics divisions of Samsung and Lucky-Goldstar, two massive Korean conglomerates, played second fiddle to Japanese competitors like Sony and Panasonic. ¶ Today, of course, Samsung is a leading manufacturer of everything from tablets to TVs, while Sony makes most of its money by selling life insurance. The renamed LG, meanwhile, continues to battle Samsung on the international stage. In the cellphone industry, for example, LG ranks fourth, behind Apple, Nokia, and market-leader Samsung. In TVs, LG ranks second, behind, yes, first-place Samsung. ¶ LG's latest salvo, fired this week, comes in the

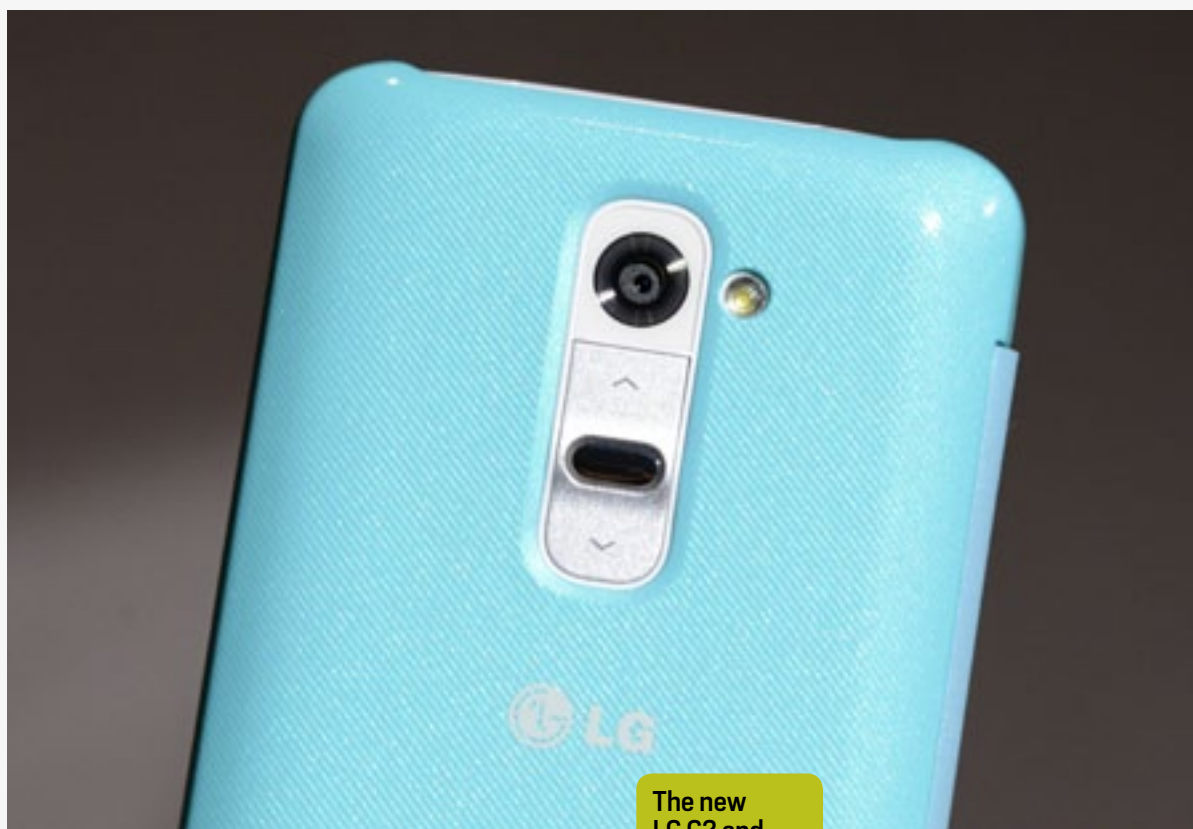
form of the G2, a flagship smartphone that left our Sarah Silbert impressed during her brief time with it. Boasting a 13-megapixel camera that can potentially hold its own against the shooters in the HTC One and Samsung Galaxy S 4, and a range of new features like AnswerMe, which lets the phone automatically connect to incoming calls when

held to your ear, the G2 could be, in Sarah's words, "a compelling flagship."

Speaking of that Japanese insurance company, this week we also took a quick look at Sony's latest high-end compact camera, the RX100 Mark II. Our conclusion: at \$750, it's certainly not cheap, but if you want the "absolute best" compact, nothing comes close.







The new LG G2 and its unique rear button controls.

In this week's Distro, we move from small gadgets to big science. Very big science, in the form of the Large Hadron Collider. Terrence O'Brien goes behind the scenes to explain

**“Samsung is a leading manufacturer of everything from tablets to TVs, while Sony makes most of its money selling life insurance.”**

how particle accelerators work, and why you shouldn't worry about a Large Hadron-induced singularity destroying the Earth. “If, and that is a big if, the LHC could create ... tiny black holes, it turns out there would be very little reason to be afraid,” Terrence writes. “Collisions of much higher energies happen naturally in

the universe all the time. As of yet, none of these collisions has led to the creation of a world-eating black hole.”

This issue also includes our reviews of two new smartphones: Motorola's Moto X and HTC's One mini. The Moto X, a mid-range smartphone at a high-end price, impressed our Joseph Volpe enough that he declared it “the smartest object that I'm currently carrying on my person,” while Mat Smith opined that the One mini is “the most appealing non-flagship smartphone we've seen in a while.” With competition like that from companies that aren't even among the top five cellphone manufacturers, LG may have more to worry about than just Samsung. **D**

*[Signature]*

MARC PERTON  
EXECUTIVE EDITOR,  
ENGADGET





# SEMANTICS IN THE MAKING, PI CASTING AND BETA BLUES



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DISTRO  
08.09.13

INBOX



MADE IN THE USA...  
SORT OF  
ISSUE 101,  
AUGUST 2ND, 2013

“A quality product made by someone who does his job professionally deserves to be bought regardless of where it was made. The US of all countries should promote this idea.”

— DINOSAUR

“‘Assembled in the USA’ is hardly new. The clothes made here are usually from foreign fab-

rics, and the fabrics from foreign yarn or thread, and the yarn or thread made from foreign fiber. Same goes for the auto industry. Many ‘foreign’ cars are assembled here, and many domestic vehicles are assembled from foreign components.

The ‘Made In’ label only refers to where final assembly took place for practically all the products we buy. In context the fact that many of the components that go into this phone are sourced off-shore is neither surprising nor unexpected.”

— KISELBLAT

THE CAMERA PHONE  
ISSUE 101,  
AUGUST 2ND, 2013

“You can easily replace your crummy pocket camera with a 1020, so the price is very much justified. Pocket cameras will face the same fate as portable CD/MP3 players.”

— SPEDEX





NEXUS 7 (2013)  
ISSUE 101,  
AUGUST 2ND, 2013

“Good to see a new version of Nexus on the way, which is not only affordable but at the same time [has] all features that one desires. Hope other big names are watching this and bring out something much cooler [than] this handset. Hence one should gear themselves up to see much more stiff competition on mobile market.”

— **FAASTCASH**

GOOGLE CHROMECAST  
ISSUE 101,  
AUGUST 2ND, 2013

“It’s nice to see that the spiritual successor to the Nexus Q is actually affordable. It’s honestly a great product.”

— **JEFFREY1234ABCD**

“Chromecast is great, but if you are a DIY kind of person, you could also buy a \$35 Raspberry Pi and install XBMC which now supports AirPlay.”

— **JASHAYANI**

JULIE UHRMAN  
ISSUE 101,  
AUGUST 2ND, 2013

“How did she  
get ahold of  
the tesseract?  
Somebody  
call Thor!”

— **ALIENCLAY**

NVIDIA SHIELD  
ISSUE 101,  
AUGUST 2ND, 2013

“While it may be bulky this is the ultimate Retro gaming solution. I would imagine running emulators on this would be fantastic. Throw in everything else it does and it seems like a solid device. If I had the extra cash I’d buy it.”

— **ROB3211**

“I do not get why NVIDIA would release this if game streaming is still in beta. Also what kills this for me is having to upgrade my

computer just to get the beta streaming.”

— **TSENDSPAM**

HISENSE SERO PRO 7  
ISSUE 101,  
AUGUST 2ND, 2013

“Nice review – looks to be a nice tablet at a good price, but for me this ‘Walmart exclusive’ is a def’ wait and see. Durability / quality is the obvious worry, especially considering more expensive tablets, from more well known manufacturers, have had quality issues.”

— **SILVER131**





# ENTER

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08.09.13

EYES-ON

## BEATS STUDIO HEADPHONES

*Tap for detail*

ADDED  
STRENGTH

BATTERY  
STATS

EXTRA  
PADDING

### OVER-EAR COMFORT

Back in 2008, Beats rolled out the first edition of its Studio Headphones and kicked off the celebrity-fronted portable audio fray. Fast-forward a few years and the outfit has a retooled set of the popular over-ears that feature improved ergonomics, 20-hour battery life and fewer grams for extra comfort.

**THE DAMAGE: \$300**





# ENTER

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EYES-ON

## BEATS STUDIO HEADPHONES



### BATTERY STATS

A handful of LEDs ensure ongoing battery stats while automatic power control switches the whole set off in the event that you forget to do so.

PHOTOGRAPHS BY WILL LIPMAN



# ENTER

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EYES-ON

## BEATS STUDIO HEADPHONES



### ADDED STRENGTH

A redesigned headband not only connects the two cans, but also holds up better under the pressure of twists and turns.

PHOTOGRAPHS BY WILL LIPMAN



# ENTER

DISTRO  
08.09.13

EYES-ON

## BEATS STUDIO HEADPHONES



### EXTRA PADDING

In an effort to aid ergonomics, the Studio Headphones' earcups are wrapped with better padding to keep listening comfy.

PHOTOGRAPHS BY WILL LIPMAN



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# LG G2

**We've just met** the follow-up to LG's Optimus G flagship, the much-anticipated LG G2. That "much anticipated" comes with a caveat, though: while there's plenty to love about LG's recent premium handsets, they haven't achieved anywhere near the same market clout as, say, Samsung and even HTC. All previous phones in LG's premium lineup have included the Optimus moniker, but communications director Ken Hong says that naming scheme will be dropped moving forward. The G2 also departs from the Optimus G with its significantly larger screen, going for a 5.2-inch display (versus 4.7 inches on the original). Brace yourselves for the biggest (albeit expected) design change on the G2: the volume and power buttons sit on the back, di-

rectly below the 13-megapixel rear camera module. We've all had the experience of accidentally hitting these buttons when gripping the phone from the upper edges, so this design is pretty intriguing.

Of course, the worry is that the buttons will unwittingly be activated when the phone is sitting on a flat surface, but LG's dodged that bullet by using curved, slightly indented keys that don't sit flush with the rest of the device. We didn't see any accidental

**PRICE: TBD**

**AVAILABILITY: 2013**

**THE BREAKDOWN: LG'S LATEST 5.2-INCH FLAGSHIP MOVES THE PHYSICAL CONTROLS AROUND BACK BELOW ITS 13-MEGAPIXEL CAMERA.**







power-ups or volume adjustments in our brief hands-on time, which is encouraging. The other benefit of having slightly curved volume and power buttons is that they're easy to find by feel. Moving the buttons to the back also allows for thinner bezels, and indeed, LG's slimmed these down compared to previous models. The top and bottom bezels measure 9.6mm and 12.9mm, respectively, while the sides are just 2.85mm. The 5.2-inch, Full HD panel is simply gorgeous; colors are vibrant,

but not oversaturated, and IPS technology allows for great viewing angles and good glare resistance. At 450 nits, it's also impressively bright.

Apart from the unique rear button placement, the G2's design isn't a dramatic departure from the Optimus G and G Pro. It will be available in both black and white, with both options sporting a subtle crosshatch pattern on the back. Design aside, the G2's real hallmark features are on the software side. Exhibit A is KnockON, which, like several Nokia Lumias, lets you turn on the display by tapping it twice. What the Lumia software doesn't allow for, however, is tapping twice to turn the screen off as well. We also discovered that the phone's software buttons can be customized to include both menu and re-

cent apps — something we've never seen before.

LG's really pushing the 13-megapixel rear camera here, and the G2's module does look pretty impressive. It boasts optical image stabilization, which should allow for solid low-light performance and anti-shake. Based on our early tests, at least, the camera performs very well — we'd say it's on par, if not superior, to the cameras in top-tier phones like the HTC One and Samsung Galaxy S 4.





# SOL REPUBLIC DECK

**Remember that SOL** Republic Bluetooth speaker that made a sneak appearance at Verizon's Droid event? Dubbed the Deck, the speaker is the result of a team-up between SOL and Motorola, with SOL providing its audio know-how and Motorola handling the wireless connectivity bit. The \$200 speaker features a flat design that might fit into a pants pocket. Vertically positioned drivers and a side-facing port provide 360-degree sound, and an outdoor mode boosts the highs and cuts the lows if you need to fill open areas with sound.

Additionally, Deck boasts a usable

**PRICE: \$200**

**AVAILABILITY: AUGUST 2013**

**THE BREAKDOWN: SOL TEAMS UP WITH MOTOROLA FOR A BLUETOOTH SPEAKER THAT BOASTS 300 FEET OF STREAMING RANGE.**

range of 300 feet, a sprawling distance compared to the usual 30-foot line-of-sight limit you'll encounter on devices like the Beats Pill and Jawbone Jambox. Its Heist setting lets up to five devices connect without needing to enable a pairing mode and, like the name suggests, any user can steal the speaker by hitting play on their device. Said mode worked seamlessly between our iPhone, Lumia 900 and MacBook Pro, each pairing quickly with mostly interruption-free connections. Better yet, every device gets assigned its own LED color in the mode so you know who hit play, but speakerphone functionality gets axed.

Getting into the sound quality, we dig the bassy and loud voicing that SOL put into this speaker. Outdoor mode isn't as full, but the treble boost does make it easier to hear in areas with more sonic pollution. As far as that all-over sound goes, the unit is actually a stereo speaker with the drivers slanted slightly opposite of each other. The effect worked well, especially with Deck at the center of a room or a table. Overall, Deck may prove to be an intriguing little speaker if the final shipping units end up with some tighter bass and slightly cleaner treble output from the drivers.



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# PHILIPS HUE LIGHTSTRIPS AND BLOOM

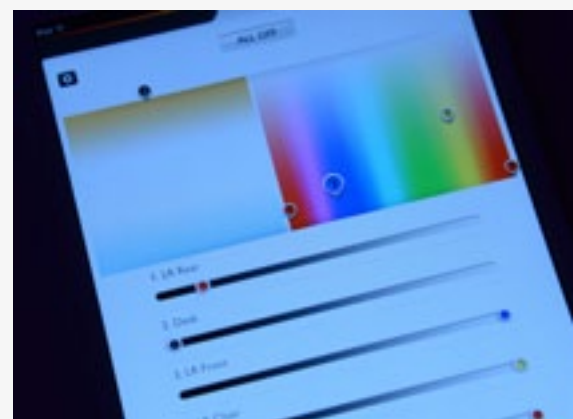
**PRICE: \$80 & \$90**

**AVAILABILITY:  
NOW AVAILABLE**

**THE BREAKDOWN: THE  
HUE SYSTEM ADDS TO ITS  
APP-CONTROLLED MOOD  
LIGHTING TO CREATE  
MULTI-COLORED SCENES  
BASED ON SNAPSHOTS.**



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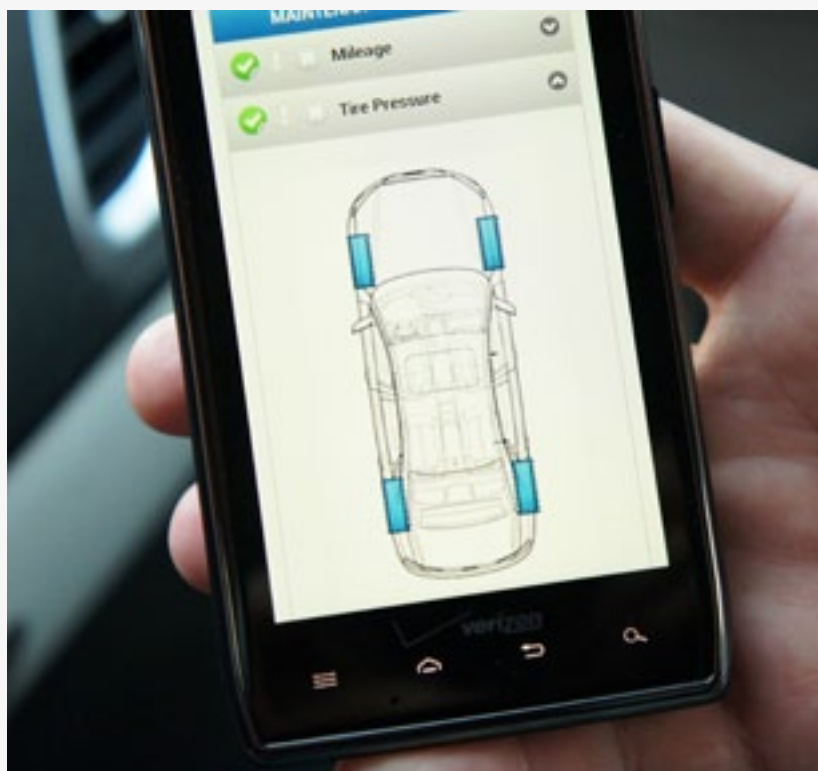


**Philips recently announced** two new add-ons for its app-controlled Hue system: LivingColors Bloom, a stand-alone portable fixture, and LightStrips, a 6.6-foot LED tape that you can affix to any surface using the included adhesive back. Both products are fully compatible with the existing Hue system, including the base station and three-bulb kit that launched at Apple Stores last year. Knowing that part of the solution's appeal is its quick and easy setup, we decided to build out a five-light rig at home using three standard bulbs, one Bloom and one LightStrips set. It took less than an hour to get up and running, including swapping out bulbs, running power to LightStrips and setting up the base station and app.

In order to take full advantage of available “scenes” (lighting-color mac-

ros based on uploaded images), you'll want to install all of your bulbs in one room or open space. You can very easily control the color and brightness of each unit using the Android or iOS app. For now, most of the available scenes support one through three fixtures, not the five you'll end up with if you have one complete kit, a Bloom and LightStrips in your home, so we avoided using scenes for the time being. If you're using app version 1.1 on iOS, you can take advantage of IFTTT integration, too, letting you set up a virtually endless number of macros. Even with five Hue fixtures in a small space, the room was a bit too dark — this solution works best for accent lighting, so unless you're prepared to use 20 bulbs in a room, you'll probably want to mix in traditional fixtures, too.





# AUTONET MOBILE

**Remember Autonet?** The company — which is best known for providing manufacturers like Chrysler with in-car WiFi hotspot solutions — is launching a new product designed to replace the key fob and enable low-latency remote vehicle control and diagnostics from any smartphone. Of course, this is nothing new — carmakers have been featuring apps to unlock doors, start the engine and monitor vehicles for some time now. Still, most existing solutions rely on satellite or 2G connectivity and often require the car's computer to be fully booted before responding to commands, which makes for a slow and unreliable experience. Autonet's new system combines in-vehicle hardware, mobile software and cloud services to

**PRICE: FACTORY INSTALL**

**AVAILABILITY: TBD**

**THE BREAKDOWN: UNLOCKING YOUR RIDE WITH A SMARTPHONE GETS A HAND FROM IN-CAR HARDWARE AND CLOUD SERVICES.**

streamline this process for both manufacturers and owners.

We recently talked with Autonet's CEO, Sterling Pratz, who demoed how the technology works. The company supplies carmakers with a board that attaches to the vehicle's CAN bus and includes a 3G radio. It's capable of powering up and connecting to the internet in less than half a second. A smartphone app provides basic keychain functionality (lock / unlock, remote start / stop, open trunk, panic on / off) and features a series of apps (car health report, geo zones, valet mode, curfew management, alarm notification, find my vehicle, speed tracker and parental controls). Of course, Autonet's cloud services tie it all together. For example, the car health report, which is really just a mobile website, lets you monitor all aspects of the vehicle, such as gas level, tire pressure and battery voltage.

Autonet's still working on several of these apps, including parental controls, which it plans to detail in an announcement later this year. In the meantime, cars are already rolling off the assembly line with the company's 3G-capable CAN bus board pre-installed and dealers can even retrofit the technology in some vehicles. **D**



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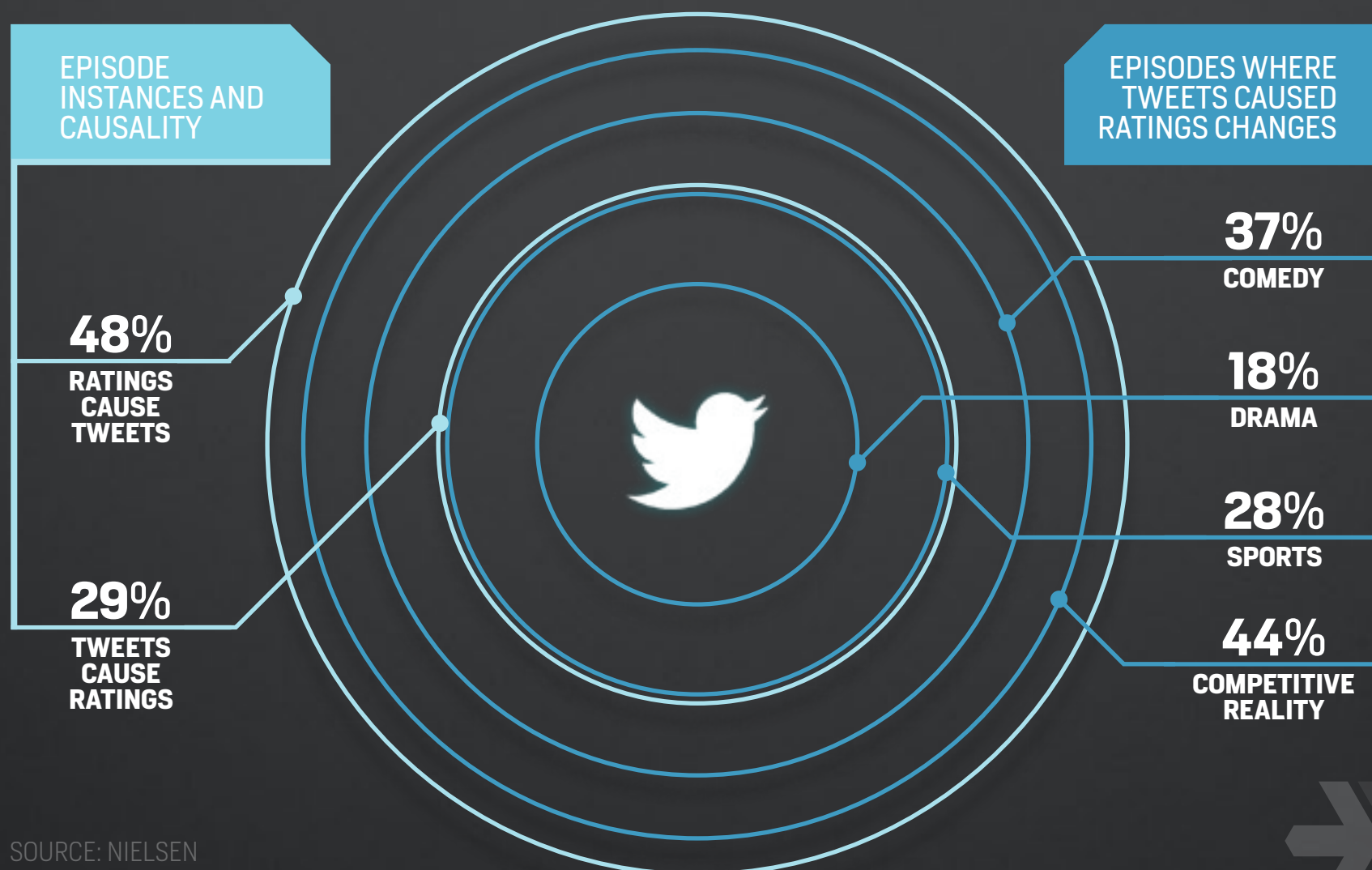




# A Little Bird Rocks the TV World

**In recent years,** social media has altered the way we interact with each other, and according to a recent Nielsen study, it's also changing the way we consume media. While it may sound like a common sense conclusion to anyone who witnessed the storm of tweets surrounding the Syfy phenomenon *Sharknado*, Nielsen has uncovered a statistical link between what people tweet and what people watch. Basically, the more people tweet about a particular show, the more people

will watch it. Likewise, the higher a program's viewership, the more likely people are to discuss it on Twitter in real time. Certain types of programming — reality TV, comedies and sports — showed a higher percentage of ratings changes influenced by social media, while things like scripted dramas showed a smaller, but still noticeable uptick. The times are a-changin', and studies like this one are bound to inspire broadcasters and advertisers to change with them. — *Melissa Grey*



# How Curiosity Became an Astronaut

By Megan Garber  
*The Atlantic*

**It may not seem like it,** but it's now been over a year since the Curiosity rover nailed its landing on Mars after "seven minutes of terror" and began a mission that can only be described as a resounding success. On the occasion of that one-year anniversary, *The Atlantic's* Megan Garber takes a look back at just how much was riding on that risky landing, and at Curiosity's place in this unique period of space exploration — both how it helped to fill the void left by the retirement of the space shuttle program, and how Curiosity itself has been "thoroughly anthropomorphized" to become something more than just a machine.



NASA/JPL-CALTECH/MSSS

## Up, Up, and Away!

By Kevin Roose  
*New York Magazine*

Kevin Roose goes to a university that could only happen in Silicon Valley: the Draper University of Heroes, founded by famed venture capitalist Tim Draper. There he finds an "an eight-week infomercial for the culture of Silicon Valley," one that ends with superhero costumes and trampolines.

## The Paradox of Wearable Technologies

By Don Norman  
*Technology Review*

Don Norman is no stranger to new technologies, having worked for decades in research design (including a stint as a VP at Apple). Here, he takes a look at some of the issues that wearable computers present us with — namely, whether they'll augment our activities or distract us, or both.

## How a Satellite Called Syncom Changed the World

By Ralph Vartabedian  
*The Los Angeles Times*

Fifty years ago last month, the world's first communication satellite went into orbit and into service. In this piece for *The Los Angeles Times*, Ralph Vartabedian looks at the team that built it and the considerable obstacles they had to overcome to top the Russian's Sputnik launch from just a few years prior.

## I Am TOM. I Like to TYPE. Hear That?

By Tom Hanks  
*The New York Times*

Yes, *that* Tom Hanks, famed actor and (to a lesser extent) typewriter collector, who here reflects on what he sees as three key reasons to own a vintage manual typewriter: the sound, the "sheer physical pleasure of typing" and the permanence. Three things that can't be said for the tablet you're probably reading this on.



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# CAN THE DIMINUTIVE CHROMECAST ELICIT BIG CHANGES?



**EDITORIAL**

DISTRO  
08.09.13

**FORUM**

**BY BRAD HILL**

**IT IS SOLD OUT AT AMAZON.** It is sold out at Best Buy online. It is sold out at the 16 Best Buy stores closest to my home in North Carolina. The nearest Best Buy availability is in Roanoke, Va. (Amazon and Best Buy are the retail outlets sanctioned by Google.) You can buy it directly from Google at the Play Store, but as of this writing, the wait time for shipping has been extended to three to four weeks.

In a world where people line up for hours to buy a \$500 tablet, selling out a \$35 dongle isn't necessarily a milestone, or an indicator of anything significant. But I'll hammer a prediction stake into the ground: Chromecast will create change in media consumption habits disproportionate to its price. Its power will come partly from its tech-candy pricing, but only partly. This little invention hits a few other sweet spots.

Google's latest thrust into the living room perhaps plunges deeper thanks to the timing. Chromecast is released just as Time Warner Cable is frothing furiously at both CBS and NBC over carriage fees. They are frothing back. It is the same old battle that has played out publicly many times, as feuding antagonists in the supply and delivery chains try to make users care about their multi-billion dollar revenue squabbles.



Dramatic publicity maneuvers usually include withholding channels from cable subscribers, while neglecting, predictably, to discount their bills.

TWC's Facebook page features plenty of recent complaints about that. I've also seen dozens of subscriber threats to ditch the service... at some point in the future. Cutting the cord is easier to forebode than to conclude in many households for one main reason: convenience.

Despite cable's many problems (price, unwanted channels, price, atrocious DVR interfaces, price, frequently awful customer service and, lest I forget to mention it, price), it does a lot of heavy lifting of content into the home. The cable platform represents an ecosystem burdened with inefficiency, but the end result is push-button selection of millions of beautiful moving pictures. Cable is timely: those who buy it are paying for first delivery of episodic content and real-time events. Believe it or not, cable's arcane machinery of strung wires and set-top boxes offers a simplicity unmatched by the balkanized, device-infested realm of streaming media.

Critics of cable often start their litany of solutions with the offhand setup, "All you have to do is simply..." Everything that follows the word "simply" is way beyond the ability and interest of average media consumers. It's like when the *Car Talk* guys say, "All you have to do is remove the carburetor." Most people take the car into the shop and pay the bill, at the mechanics' mercy,

## The subtle killer aspect of Chromecast is that it accommodates the user.

or buy a new car. Many households pay the cable bill, at the mercy of the cable company, and keep buying new TVs.

The subtle killer aspect of Chromecast is that it accommodates the user rather than the user's exasperating ecosystem of content owners and distribution companies. Our computing ecosystem is separate from our TV ecosystem, despite years of attempted convergence. Chromecast is not an add-on to the TV ecosystem; it is a link-in to the computing ecosystem. It makes the TV smarter by circumventing some of its cumbersome attachments.

Chromecast is not the only wireless HDMI device that puts content on the television screen, not by a long shot. But it is the one that converges the TV with what many people are doing on the couch while watching TV. Chromecast attempts to link the user's normal couch-computing activity (running a streaming app on a tablet, or trolling for video in a browser) into the TV without fuss of cables, and without the awful TV remote. It turns your phone or tablet into a remote





# I am not predicting Chromecast will change the media / tech landscape ... But it has enough solution power to nudge some cable-cutting fence-sitters.

controller that flings media onto the TV. (Even better, when integrated apps are used, they fling instructions to Chromecast, then release the tablet or phone while Chromecast streams the content directly from the internet.)


I have Roku, and value it, but Chromecast executes an end run around Roku by circumventing its painful interface and obviating the wretched Time Warner remote. Which would you choose — surfing Netflix with a Time Warner remote control in Roku's blocky environment, or with a Nexus 4 running the Netflix mobile app?

Many prospective users, and even adopters who have placed orders into the waiting period, might not realize the whole attraction. That \$35 price tag is deceptive. Chromecast elegantly plays into consumer trends as users migrate from DVD to streaming, from cable to severed cable, from weekly episodes to binge watching, from focused viewing to multitasked viewing, from computer in the den to computer in the pocket. Google's little device ties all this together into a compelling convergence

play in which the television becomes an extension of mobile.

I am not predicting Chromecast will change the media / tech landscape like the laptop or the smartphone. But it has enough solution power to nudge some cable-cutting fence-sitters. Its simple setup and accommodation to existing habits provide a compelling convenience factor, and convenience is what the media distribution business is built upon.

Chromecast might end up being another museum piece in the trail of debris littering the long and ineffective path of computer / TV convergence. Or its success might be merely partial, limited by refusal of streaming distributors to integrate with Chromecast — at launch, Netflix was the only non-Google service on board. Google needs Hulu and Amazon Prime for a solid base, notwithstanding Chromecast's ability to stream from a Chrome browser tab.

But if there is industry leverage, and even a little genius in this cheap dongle, it lies in its service to existing consumer behavior, rather than trying to change consumer behavior. 



# CASTING LIGHT ON THE CHROMECAST

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08.09.13

FORUM

SWITCHED  
ON

BY ROSS RUBIN

**SOLD OUT FOR WEEKS** after its launch, everyone seems to be in love with the Chromecast — the ultra-cheap, ultra-small, interface-free, HDMI-toting TV appendage that stole the show from the new Nexus 7. Building beyond the DIAL device-discovery protocol that Netflix and YouTube have supported, Chromecast is a client of Google Cast, which enables the kind of second-screen control for volume and other features implemented by the device.

Google has gotten the jump on similar products such as the Plair TV dongle by natively supporting three of the most popular services to use on televisions — Netflix, YouTube and Pandora. Furthermore, it has also enabled a backdoor to many other services by building in support for displaying Chrome tabs on a Chromecast-connected TV. In doing so, it treats the TV as an extension of the browser just as Apple's forthcoming OS X Mavericks can treat an Apple TV-connected set as another Macintosh screen.

The Chrome brand may not mean much to consumers at this point (at least compared to Android), but it's shaping up to represent a few things to Google, which marked the metallic name's focus on simplicity. But unlike other competitive products that marry simplicity with sophisticated, premium industrial design, the Chrome brand connotes affordable simplicity. For example, in their marketplace ascent, Chromebooks have become the new netbooks — truer to that name, in fact, than the Windows-based versions ever were.








Chromecast is very much in keeping with the Chrome ethos. It runs on Chrome OS, which means that its software layer is essentially a browser. It also encourages HTML-based development, which — despite the strong software support that Android has received — remains Google's desired endgame. Chromecast is cross-platform, but very much tied to the Chrome browser. In fact, Google's introduction of the device portrayed the mobile device universe as consisting only of Android and iOS devices, the only ones on which Chrome is available.

But Chromecast is more than a cross-platform play; it's a countermove against WiFi extensions such as AirPlay, which will likely never move beyond the iOS ecosystem; it also does this without using Miracast, the Wi-Fi Alliance's attempt to build its own answer to AirPlay, and for

which Microsoft recently announced support in Windows 8.1.

Two years ago, Switched On discussed some of the key challenges of smart TV. At least three different approaches — including the disastrous Nexus Q — have tried using Android to crack it. But recent findings from Reticle Research show that the feature consumers are most interested in from a smart TV is the ability to send content from a smartphone or tablet.

Perhaps frustrated by Google TV's slow adoption, Google has launched Chromecast as a hedge, a bet that TV may not enter into a robust app ecosystem the way that Samsung and others think it will. While it continues to play both sides of that bet, it has just tipped the scales a bit in favor of a solution that's simpler, more focused and — assuming you have the requisite second screen — much cheaper. 



# THE DAY GOOGLE DIED

DISTRO  
08.09.13

FORUM



THIS IS THE  
MODEM WORLD

BY JOSHUA FRUHLINGER

**One day**, Google will not be the technology giant that it is today. Consider the following:

In 1968, the Pontiac GTO was *Motor Trend's* Car of the Year. Today, Pontiac is a historical footnote of General Motors.

In 1981, IBM launched the PC, which became the de facto standard of personal computers, spawning hundreds of PC clones and dominating the computing market to this day. In 2005, the IBM PC business was acquired by Lenovo, and the IBM PC is no more.

In 1997, AltaVista was the rising star of web search engines, earning an unheard-of-at-the-time \$50 million in sponsorship revenue in one year alone. On June 28, 2013, Yahoo shut down AltaVista after years of experimentation as a portal and ultimate failure, replaced by the much more powerful Google search engine.

In 1999, Palm Computing launched the Palm V, a beautiful aluminum device that still defines modern hardware design today. After an acquisition by HP, the Palm brand was unceremoniously shuttered in 2011.

I think you can see where this is going.

Technology brands, like nation states, are ephemeral. What is today's behemoth of a product is tomorrow's Wiki "See also." We see brands become dominant players, expand their portfolios, spread themselves too thin and split apart at the seams. It happens time and again, and I think it's pretty fair to say it'll happen again, in this case with Google. Of course, each of these examples has their own stories and idiosyncrasies, but the story is a short one: create innovative product, explode onto the scene, get huge, try to replicate, spend all your money, lose your talent, spin your wheels, die.

"Google? Die?!" you say? Yes. It could happen for exactly the same reasons other brands have failed.

When Google started in 1996, it was just a couple Ph.D. students' attempt at fixing web search. By 2011, it passed a billion unique visitors per month. As of today, it has a market cap of almost \$300 billion. For comparison's sake, General Motors has a market cap of around \$50 billion. IBM's is around \$200 billion.

Of course, Google isn't going anywhere any time soon. But people love to imagine





## “Maybe Bing will finally jump out ahead...”

where Google will be in 10 years, imagining a future dominated by Google Television Networks, Apple cars and Samsung homes, and I’m here to say that those predictions may be a bit myopic.

But isn’t it possible that we’re seeing Google spread itself thin at this very moment? A quick look at its product portfolio could give that impression. To an investor and fan, you’d simply say that they’re just diversifying, which is what any good business should do. But how far is too far? At what point does Google thin out?

Google is still, at its core, a search engine. And it dominates the internet with that, telling us what is and what isn’t relevant, and it does an excellent job of it. But beyond that, Google has a mobile operating system, a computer OS and accompanying laptops, email and online productivity tools, a translation service, a news aggregator, a small high-speed fiber network, a web browser, a social network, a wireless payment system and a wearable HUD.


That’s quite a list, and it’s totally reasonable to say that if any of those things failed, Google would be absolutely fine. The shutdown of Wave and Reader certainly didn’t ding it outside of some snarky commentary from the press.

But what happens in 10 or 20 years if these products haven’t matured into things we use every day like Gmail? (Though, to be fair, several already have.) Does Google lose its luster and become

another General Motors that needs to reinvent itself and show that it can be innovative just like the little guys? The writing is on the wall, perhaps, and if we’ve learned anything from the history of corporations, imagining a future dominated by Google is probably only half-accurate.

And if you think that Google will be the top search engine forever, keep in mind that the internet is still very young. We’ve already seen HotBot, Yahoo, Excite, WebCrawler, Ask Jeeves and Alta-Vista come and go. Who are we to assume that Google is the final search engine? As Facebook fine-tunes its social-based Graph Search, we’ll probably see more socially relevant engines heat up. Maybe Bing will finally jump out ahead with more meaningful results. Meanwhile, as content continues to shift away from simple text and graphics, new algorithms will be required in order to make results relevant. Soon we won’t just be looking for article headlines, images and videos. We’ll be looking for networks, trends, memes, geographies and more.

In short, Google as we know it will die. I don’t know when, but history is bound to repeat itself. Perhaps it’ll shift its focus, and maybe that’s why Google is getting its feet wet in just about every technology, hedging its bets, ready to dominate the next big thing.

Either way, I think there’s a good chance that Google won’t be the search engine of choice for your children. 



# REVIEW

DISTRO  
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**Samsung  
Galaxy Tab 3  
8.0**



**HTC  
One  
mini**

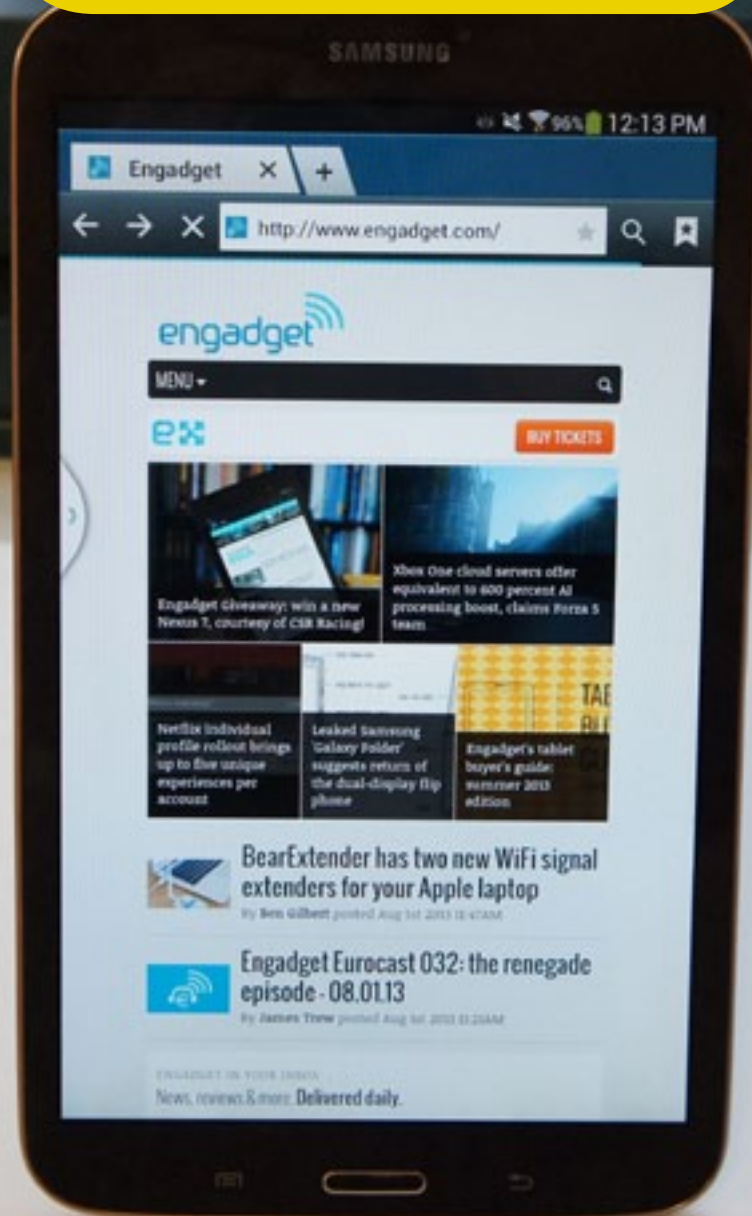


**Moto X**





## SAMSUNG GALAXY TAB 3 8.0



Samsung offers slates in all shapes and sizes, but does the **Galaxy Tab 3 8.0** hit the bullseye?  
**By Sarah Silbert**

**For all intents and purposes**, eight inches is the new sweet spot for tablets. We've so far seen a few hits with this form factor, the Samsung Galaxy Note 8.0 perhaps foremost among them. It makes sense, after all; 10.1 inches can be unwieldy for travelers, and seven inches scrimps a bit on screen real estate. Samsung's leveraged this trend to add another 8-incher to its lineup: the \$300 Galaxy Tab 3 8.0. With 16GB of built-in storage, a dual-core processor and WiFi — but not LTE — support, it's hardly revolutionary apart from those novel dimensions. Still, we've found plenty to like with



Galaxy Tabs in the past, so is this yet another strong contender?

## HARDWARE

The Tab 3 8.0 may not have the name recognition of Samsung's Galaxy Note 8.0, but what it does have in its favor is a svelte, lightweight design. At 10.9 ounces (309.1g), it's comfortable to hold one-handed, and at just 0.29 inch (7.36mm) thick, it makes the 0.31-inch Note 8.0 look (and feel) positively bloated. While we appreciate that Samsung shrunk the bezels on this model, it does make it hard to grip the slate up top without touching the display; you'll want to hold the tablet at the bottom to avoid unintentional input. Incidentally, you'll *also* want to avoid gripping the

tablet at the top so you won't hit the volume rocker on the upper-right edge.

Slimness aside, the Tab 3 8.0 also feels more premium than the Note and even the last-gen Tab 2 line, thanks to those skinny bezels and a brown-black hue done up in a dimpled pattern. While we're not huge fans of this color — our very own Joseph Volpe calls this shade “scab brown” — it's not as reflective as Samsung's usual white and black options, meaning the tablet's plastic build is a little more pleasing to look at. (Should you prefer a more standard color choice, you can always opt for the white version.) This textured finish also helps mask the fingerprints that will inevitably grease up the tablet's backing, though you'll still want to wipe

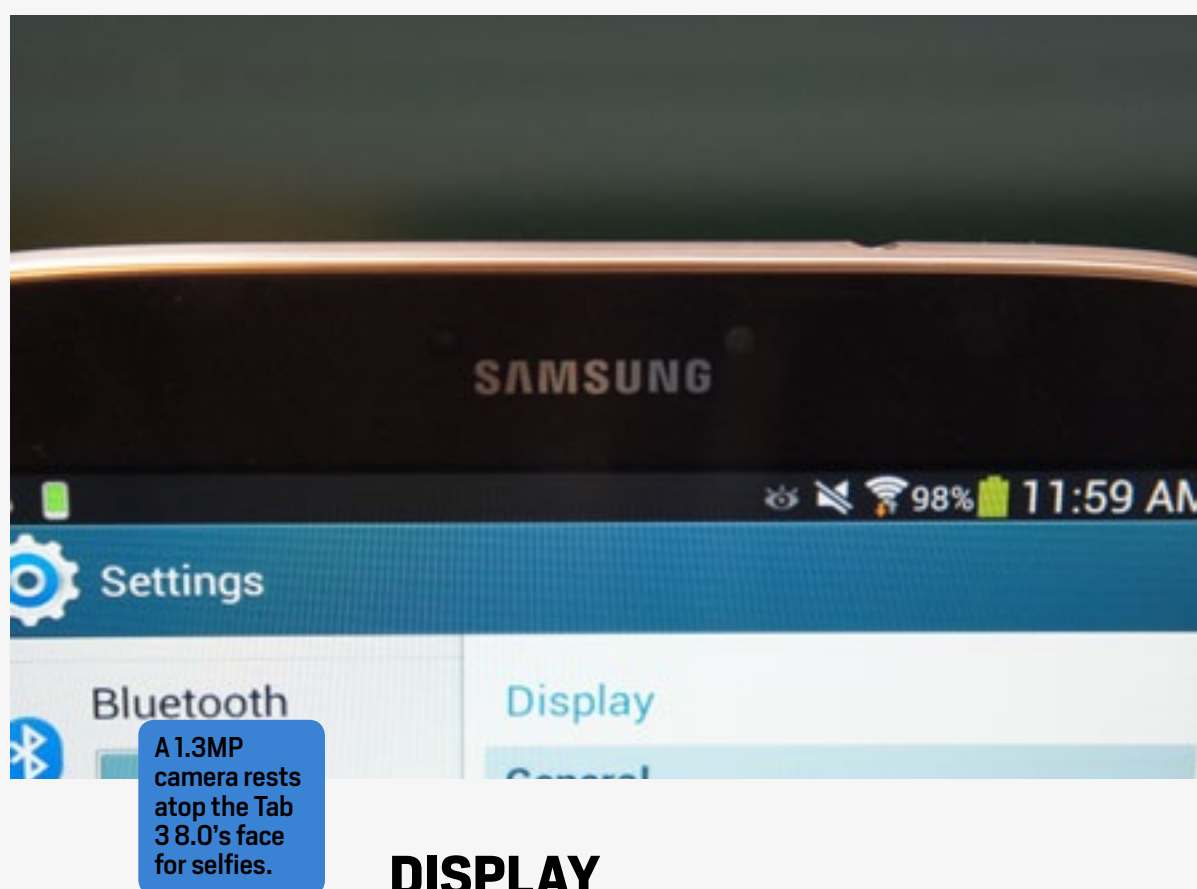
Aside from standard white, “scab brown” is offered too.





down the tablet regularly. Another sweet touch: the bronzy faux-chrome trim lining the tablet, which adds a bit more flair than the standard silver trim (which you'll still see on the white Tab 3 8.0). This flourish carries over to the Tab's backside, where the 5-megapixel rear camera is surrounded by the same material.

We've just about covered all the surprises on the Tab 3 8.0: port placement is par for the course, as is the Samsung branding sitting both atop the touchscreen and in the middle of the device's non-removable back cover. On the front of the device, you'll find a 1.3-megapixel camera up top, while the physical home button sits below the display, flanked by capacitive keys for settings and back. A microSD slot sits on the left edge of the slate, while the power button and volume rocker line the right side. The right edge is also home to an IR blaster, which lets you use the tab as a remote control for your TV. Samsung's been pushing this feature on several tablets, including the new Tab 3 10.1 and the Galaxy Tab 7.0 Plus from almost two years ago. As usual, the headphone jack sits on the top edge, while the micro-USB port sits on the bottom along with two mini speaker grilles.



## DISPLAY

Samsung used a 1,280 x 800 (WXGA) TFT LCD panel for the Tab 3 8.0, and that resolution makes for a fabulous viewing experience. Images and text are perfectly crisp, and colors look reasonably vibrant as well. On top of that, viewing angles are nice and wide, though you'll have a harder time using the tablet in direct sunlight; the panel is definitely glare-prone. The 10.1-inch version of the Tab 3 also packs a WXGA resolution, which means the Tab 3 8.0's panel has a higher pixel density (148 pixels per inch versus 189).

## SOFTWARE

Running Android 4.2 (Jelly Bean), the Galaxy Tab 3 8.0 offers a few standout features along with the standard suite of Samsung apps. These include Peel Smart Remote, which utilizes the tablet's IR blaster to control your TV, and the recently introduced Smart Stay for detect-





ing when you look away from the screen and pausing and resuming your videos accordingly. Notably, Smart Stay is the only “Smart” feature to make it over to this tab — most of these bells and whistles live exclusively on the GS4, at least for now.

For the most part, Samsung leaves the app-collecting to you, only loading up the Tab 3 8.0 with a handful of pre-selected programs. These include Dropbox, Flipboard and TripAdvisor along with the expected parade of Samsung programs (ChatON, Game Hub, Group Play, S Voice, S Planner, WatchON — you know the drill).

## CAMERA

While the Tab’s older sibling, the Tab 3 10.1, packs a 3.2-megapixel rear camera, we get a 5-megapixel shooter to

play with here. Many people will appreciate the simple camera UI, which offers a straightforward settings menu on the right-hand side of the screen. The camera app gives you several modes for snapping pics: the self-explanatory Auto, Beauty Face, Night, Panorama, Sports and Sound & Shot. Our sample shots deliver ac-

curate, if not entirely vibrant, colors, though images tend to look a little fuzzy. You’ll want to avoid shadier, darker environments, as we didn’t have much luck in those conditions. Overall, the shooter will do in a pinch, but you’re much better off with a standalone point-and-shoot (as if you didn’t know that already).

You can also shoot video in 720p, but don’t expect extremely fluid movement. Our sample clip looks quite jerky, and autofocus





didn't do a great job at making objects look crisp. On the upside, audio came through loud and clear, with limited background interference. Finally, there's a 1.3-megapixel front camera, which is adequate for selfies (if you must) and video chats. We look a bit washed-out in our sample shots, but that's to be expected.

### PERFORMANCE AND BATTERY LIFE

With a 1.5GHz dual-core Samsung Exynos 4 processor and 1.5GB of RAM, the Tab 3 8.0 is no match for slates running higher-end silicon. When we first powered on the tablet, the system was a mess of hiccups such as force closes and several seconds' delay in response. We weren't exactly thrilled at the prospect of using the slate after those first

few minutes, but luckily the going got smoother soon after. That's not to say you won't encounter the occasional stuttering or freezing; as we found with the Tab 3 10.1, everyday performance is frustratingly inconsistent. The camera app seems especially prone to upsetting the tab; it force-closed on us at least five times during our few days of testing.

Synthetic benchmarks tell the same tale: the Tab 3 8.0 is capable enough, but it's no overachiever. On Quadrant, for example, the machine trailed the quad-core Galaxy Note 8.0 by more than 2,000 points. On the JavaScript benchmark SunSpider, however, the Tab 3 8.0 managed a score of 798, though it's not as good as the new Nexus 7's result of 602 (lower scores are better here).

BENCHMARK	SAMSUNG GALAXY TAB 3 8.0	SAMSUNG GALAXY NOTE 8.0	SAMSUNG GALAXY TAB 3 10.1	GOOGLE NEXUS 7 (2013)
QUADRANT (V2)	4,522	6,830	6,564	6,133
VELLAMO (V2.0 HTML5)	1,541	1,766	1,694	1,597
ANTUTU	10,128	17,687	22,042	19,755
SUNSPIDER 0.9.1 (MS)	798	1,005	1,399	602
GLBENCHMARK 2.5 EGYPT 1080P OFFSCREEN (FPS)	16	17	N/A (WOULDN'T RUN)	40
CF-BENCH	8,219	15,128	6,329	15,366
BATTERY LIFE (RUNDOWN TEST)	7:19	7:18	6:55	7:15

SUNSPIDER: LOWER SCORES ARE BETTER



<b>TABLET</b>	<b>BATTERY LIFE</b>
<b>SAMSUNG GALAXY TAB 3 8.0</b>	7:19
<b>APPLE iPad MINI</b>	<b>12:43 (WIFI)</b>
<b>APPLE iPad (LATE 2012)</b>	11:08 (WIFI)
<b>APPLE iPad 2</b>	10:26
<b>ASUS EEE PAD TRANSFORMER PRIME</b>	10:17
<b>ASUS MEMO PAD HD 7</b>	9:56
<b>APPLE iPad (2012)</b>	9:52 (HSPA) / 9:37 (LTE)
<b>NEXUS 7 (2012)</b>	9:49
<b>MICROSOFT SURFACE FOR WINDOWS RT</b>	9:36
<b>APPLE iPad</b>	9:33
<b>ASUS TRANSFORMER PRIME INFINITY TF700</b>	9:25
<b>SAMSUNG GALAXY TAB 2 10.1</b>	8:56
<b>SONY XPERIA TABLET Z</b>	8:40
<b>HISENSE SERO 7 PRO</b>	8:28
<b>GALAXY TAB 2 7.0</b>	7:38
<b>HP SLATE 7</b>	7:36
<b>NEXUS 10</b>	7:26
<b>SAMSUNG GALAXY NOTE 8.0</b>	7:18
<b>NEXUS 7 (2013)</b>	7:15
<b>RIM BLACKBERRY PLAYBOOK</b>	7:01
<b>SAMSUNG GALAXY TAB 3 10.1</b>	6:55

On our battery test — which involves playing a local video on loop with WiFi on and brightness set to 50 percent — this Tab's 4,450mAh power pack lasted seven hours and 19 minutes. That's on par with the Galaxy Note 8.0, the new Nexus 7 and the HP Slate 7, though a couple 7-inchers like the ASUS MeMo Pad HD 7 and the Hisense Sero 7 Pro last several hours longer. Of course, you can expect more longevity with more moderate use; we easily got through a full day with occasional emailing and light gaming, for instance.

## THE COMPETITION

When you can take home the Galaxy Note 8.0 with its superior performance and S Pen for just \$100 more, the Tab 3 8.0 is a bit of a tough sell. Yes, the latter does offer a thinner design and runs Android 4.2 rather than the Note's Android 4.1, but those advantages only tip the scale so much. If you want to stay within Samsung's galaxy, we'd say you're better off going for the Tab 3 8.0 than the pricier Tab 3 10.1, as its smaller size makes it a more compelling travel companion and the difference in performance is negligible.

Outside of Samsung's ecosystem, you have a few other options as well. The new Nexus 7, retailing for \$229 and up, has wireless charging and a brilliant 1080p display in its favor — not to mention a very reasonable price. And if you're wed to the 8-inch form factor (and open to another OS), the 7.9-inch







Performance  
woes  
plague this  
Samsung  
8-inch slate.

iPad mini's impressive battery life and access to the App Store could be good reasons to shell out \$329-plus. The bottom line is that both of these options are far more memorable than Samsung's latest 8-incher, and we're coming to expect standout features on tablets in exchange for our dough.

## WRAP-UP

Our biggest knock against the Samsung Galaxy Tab 3 8.0 is its finicky performance, which admittedly is no minor complaint. Beyond that, though, the biggest fault we can find with the Tab is that it's simply not memorable. Sure, if you have \$300 to spend and want an 8-inch Android tablet, it's an option worth considering. Is it the best use of your money,

though? No, you can do better for a little more cash — and even a little less.

*Edgar Alvarez and Daniel Orren contributed to this review.*

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*Sarah is Senior Associate Editor, a wannabe tap dancer and a closet film critic.*

## BOTTOMLINE

### SAMSUNG GALAXY TAB 3 8.0

## \$300



## PROS

- Crisp, bright display
- Slim design
- Runs Android 4.2

## CONS

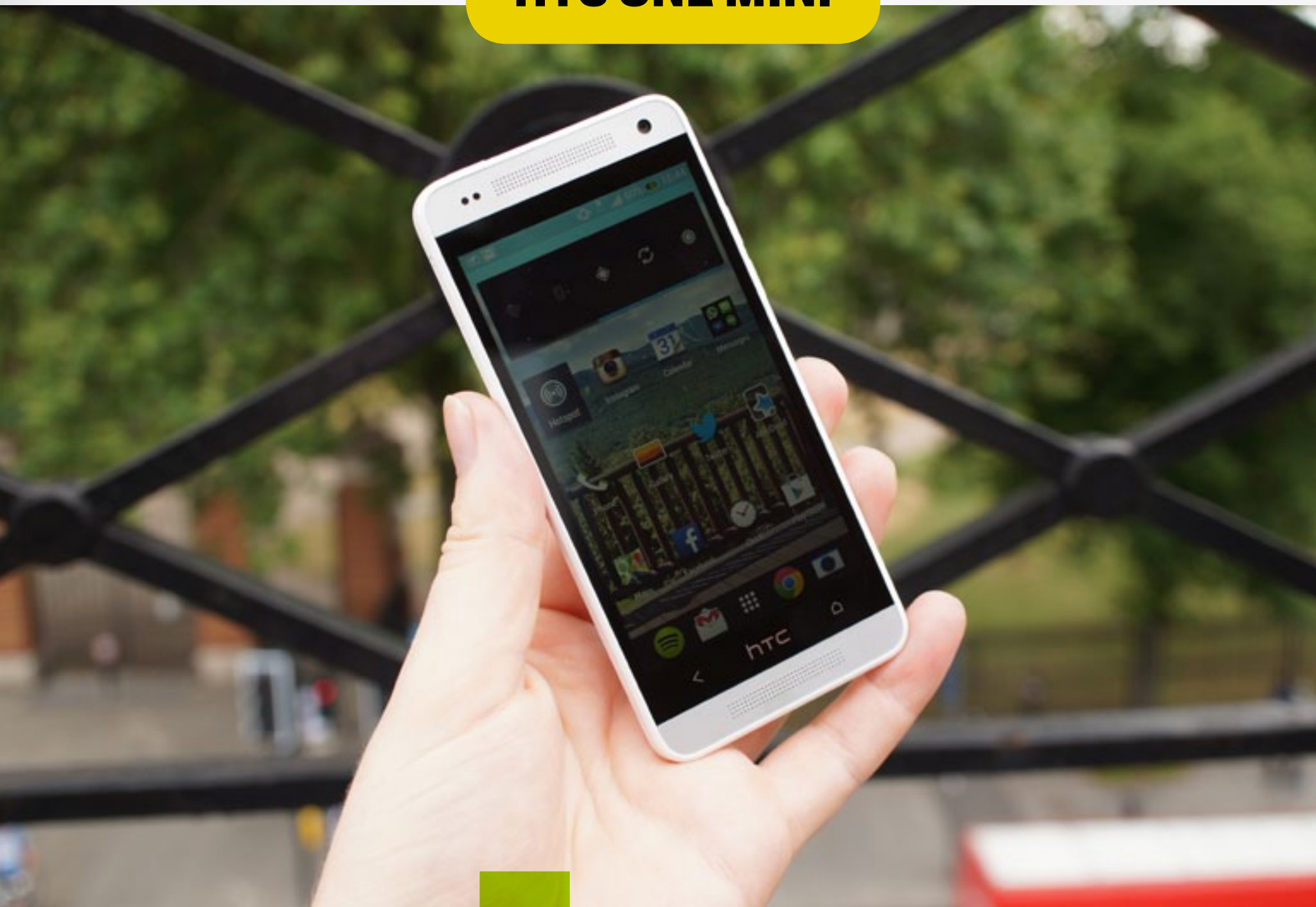
- Glitchy performance
- Unremarkable compared to competitors

## BOTTOMLINE

The Galaxy Tab 3 8.0 features a nice display and a slim design, but it's otherwise a forgettable device.



## HTC ONE MINI



The **HTC One mini** is a hand-friendly smartphone rooted in the same design as its elder sibling, but are consumers ready to give up their screen real estate?  
**By Mat Smith**

**Just weeks after we** put the Samsung Galaxy S4 Mini through its paces, we're looking at the HTC One mini, another attempt to shrink a flagship down into a smaller (and cheaper) package. As you'd expect, the 4.3-inch mini looks much like the full-sized version, and that goes for both the hardware and software. In addition to its similar-looking aluminum-and-plastic frame you'll find both a 4-megapixel UltraPixel camera sensor and HTC's Sense 5 UI, meaning automatic video highlights, Zoe and BlinkFeed all make an appearance here as well. There are,





however, a few hardware drawbacks compared to the original, with the IR blaster, optical image stabilization (OIS) on the camera and NFC stripped out for space- and cost-saving reasons. Can HTC launch a mid-range phone that won't get lost between similarly priced offerings and last year's discounted flagships? We'll try to reason that out as you read ahead.

## HARDWARE

The physical similarities to the HTC One are glaringly obvious — and it's a huge part of the mini's appeal. HTC is certainly not the only phone maker trying to inject some flagship charm into its cheaper handsets. Borrowing much of the design language first seen in the One, the mini is mostly wrapped in aluminum. The front panels are actually slightly rougher than the surface of the original model, although the backing has the same smooth finish. However, it doesn't sport the matte seam of plastic we saw on the original One; instead it has a glossy, white all-plastic frame, reminiscent of last year's unibody One X.

The physical similarities to the HTC One are glaringly obvious — and it's a huge part of the mini's appeal.

The mini has a gloss white seam, where the One has a matte finish.



The body still follows the same palm-friendly curve, although both the camera unit and flash are center-aligned on the back this time around. There are also two white plastic lines breaking up the all-aluminum cover, ensuring the unit's antennae work and also creating the illusion that you might be handling the pricier flagship model. The volume rocker on the right edge is now comprised of two keys, but they're still thankfully made of metal — no nasty metal-finish paint here. That plastic edging is visible on the front, so unfortunately you won't get the same chamfered-aluminum edge as the One.



That's a shame, as that chamfering was one of the design flourishes we loved most on the original.

HTC's BoomSound speakers lie beneath micro-drilled holes both above and below the screen, bringing plenty of oomph, as advertised. Prolonged listening through the smartphone won't grate on the ears, although the sound quality isn't quite as bass-rich as the One. HTC also snuck in a single LED notification light into the top speaker — one of the more refined ways we've seen light-up reminders integrated into smartphone design. The not-quite-standard Android button layout remains, with an HTC logo separating back and home keys. As it's running Android 4.2.2, however, HTC now offers you the option to switch some of the menu button functionality to the home key, launching Google Now with a swipe and accessing the options menu within apps.

But the mini has something on its big brother: it's arguably a better size. We could grasp the device, slip it into pockets or bag side pouches and use it one-handed without issue. Reaching with a thumb on larger screens (and reducing your hold on the device in the process) increases the chances that those hundreds

of dollars you just sank into a new smartphone will end up a splintered chalk outline on the concrete. We're enjoying this apparent return of more sensibly sized handsets, though it's something you may not appreciate until you switch from a larger to a smaller phone for a sustained period.

Now about that screen: the 4.3-inch display beams out Android at a resolution of 720p. That means, then, that there are fewer pixels than the One, but it's still leagues ahead of its qHD rivals. We're more than happy to drop down to this resolution from 1080p, especially when it's been accompanied by a reduction in screen size. In fact, it appears to be identical to the display found on HTC's Facebook experiment, the First. Same resolution, same size and, well, same conclusions. HTC uses Super LCD 2 tech, which gives pretty accurate color reproduction and it's easy to share pictures and

BoomSound speakers kick out the jams with gusto on the mini.





videos with strong image quality at off-angles. Our only complaint is that we wish it were a little less reflective and a little more readable in sunlight.

Underneath the screen, there's a dual-core, 1.4GHz Snapdragon 400 processor (another component that made an appearance in the HTC First), along with 1GB of RAM and 16GB of built-in storage. Given that the One mini is completely sealed, there's no opportunity to expand storage through a microSD card, but it's a pretty respectable chunk of storage for a phone below the flagship level.

There are some features that didn't make it to the One mini, however, and our biggest regret is the loss of the IR blaster. Yep, I'm one of those people who's begun to ignore my AA-powered TV controllers and navigate through channels and TV menus almost exclusively on an IR-capable Android device — whether it's a Galaxy S 4, HTC One or Xperia Tablet Z. I inadvertently tried to launch the remote app several times while working on this review and while it's not a hardware feature everyone was going to use, I already miss it. Remote functionality would also have made a great talking point when going up against rival devices. NFC didn't make the cut either. If that (and maybe the

IR blaster) were the only omissions, we'd be okay with the minor price difference. However, there's also the reduced screen resolution, the lesser processor, reduced storage and RAM, and the lack of optical image stabilization, which is supposed to work in tandem with HTC's UltraPixel camera to improve shots. That's quite the list of cuts.

## CAMERA

The HTC One mini packs *largely* the same camera sensor as the debut One model. The technical spec sheet says it's a backside-illuminated sensor paired with an f/2.0 lens — both good things. In case you missed all the discussion earlier this year, HTC's UltraPixel camera might take a bit of explaining. The maximum image resolution is capped at four megapixels, but it's not all about the pixels. The way HTC created this camera sensor offers a larger area for light to bounce off and the opportunity for more light to hit it.

Some daytime shots saw washed-out highlights.



This means you'll get better low-light shots and less noise; less flecks of blue and red in your nighttime photos.

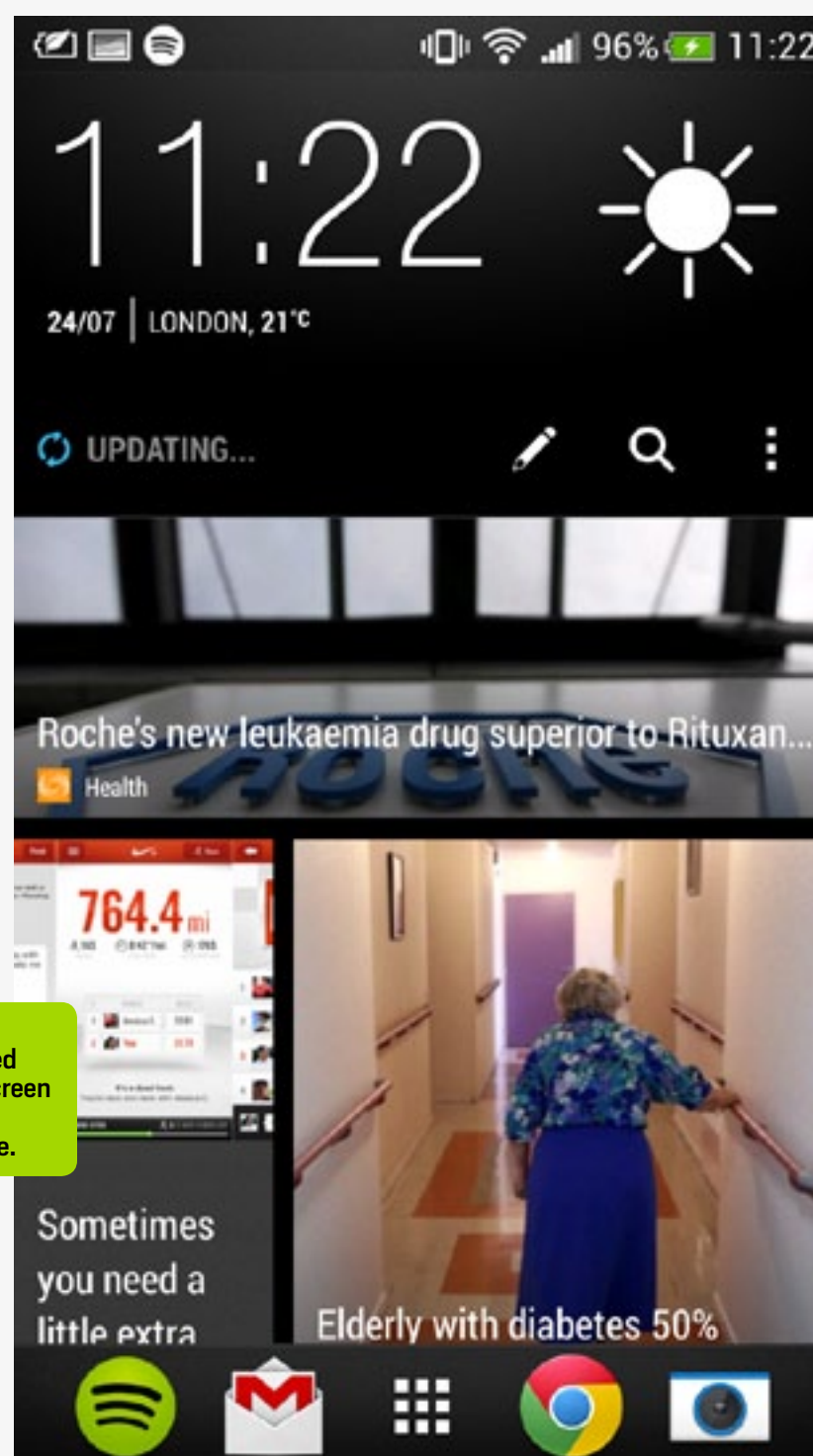
The One mini can capture 1080p video (even in HDR) and in our daytime test video, a group of white birds appeared a little too washed out. The camera's dynamic range has issues keeping the light levels properly balanced, unfortunately. However, video recording was responsive enough to capture butterflies in flight.

Our sample shots also hinted at strong performance. In fact, compared to last year's major smartphones and the current mid-range phones, the mini could place in the top three — regardless of pixel count. Unfortunately, it doesn't have optical image stabilization (and a few of our shots visibly demonstrated this) but HTC's UltraPixel camera holds onto its Lumia-baiting skills in low-light photography.

A quick flurry of photos taken in a dim bar at night showed lots of detail and minimal noise. However, the lack of OIS is presumably why our One mini pictures were a bit less sharp than what we got with the One. With bright lighting, some shots were washed out, regardless of whether we used the HDR mode. The front-facing camera here is a perfectly serviceable 1.6-megapixel shooter, although the lack of the wide-angle lens seen on both the HTC One and Windows Phone 8X is a bit of a shame and constrains how many friends you'll be able to cram into your selfies.

## SOFTWARE

BlinkFeed, Zoe and HTC's addictive automated video highlight reel feature make the One mini *feel* like the original. Running on Android 4.2.2 (and packing some software additions that the flagship also recently received), HTC's restyled Sense has grown on us. Sure, it's still divisive, but the black-and-white scheme is understated and the added functionality includes things we actually use — something we can't say about



The BlinkFeed home screen isn't for everyone.





the raft of new features Samsung adds to its yearly flagships. There are some smaller additions in this latest version of Android that we'd like to mention in passing, including a percentage battery level indicator in the status bar and a quick-setting panel (with toggles for WiFi, Bluetooth and more), which you can access by dragging two fingers down from that status bar. Finally, HTC's matched a feature that's long been available on Nexus devices.

We're still not completely sold on BlinkFeed; we'd prefer instead to make the stock Android screen our de facto home base. The topics and services available to add to the news and social feed haven't noticeably changed (or expanded) since HTC launched the service. All told, it still feels like a protracted way for us to browse through social network content; some efforts to curate or focus on popular tweets, like Twitter does itself in its own discovery tab, would have been welcome.

On to the good stuff. HTC has refined the camera option menus making access to different settings easier and adding a new file format to its Zoe captures (a video-and-still-frame combination), ensuring that any Google+, SkyDrive or Dropbox account you own no longer gets filled with lots of similar-looking shots. Video Highlight options have now been expanded to include six extra themes. Even more importantly, perhaps, you can now add your own music, as BlackBerry Z10 users have

been doing on BB10.

Within the camera app itself, you can also now lock exposure and focus on the viewfinder screen. Pressing-and-holding will fix both, and you can also unlock with a subsequent tap, expanding your options for nailing that shot. In an attempt to ameliorate the loss of optical image stabilization, HTC has added a software-based feature to reduce shakiness. Unfortunately, using it leads to a significant drop in the level of detail. We'd recommend you use the camera without it — we did. We'd also like to mention HTC's Sync service, which stores apps, WiFi passwords, home screen layouts and more within a Dropbox file. Thanks to this, we were able to transfer our smartphone settings from an older HTC One without a hitch. This setup also offers a stress-free way of recovering your phone's layout and content should you ever lose (or have to replace) the hardware itself.

## BATTERY LIFE AND PERFORMANCE

Smaller phone, smaller screen and, yes, smaller battery. At 1,800mAh, we wondered where that would place the device when it came to lasting out the day. In our video-looping test, with brightness at 50 percent and social networks polling at 15-minute intervals, we got just over six hours. It's a bit disappointing, frankly. While it's a half-hour less than the full-sized HTC One managed, we were hoping that a drop in resolution and screen size would translate



BENCHMARK	HTC ONE MINI	SAMSUNG GS4 MINI	HTC ONE
QUADRANT 2.0	5,200	7,250	12,495
VELLAMO 2.0	2,118	1,980	2,429
ANTUTU 3.2	10,048	13,732	25,140
SUNSPIDER 1.0 (MS)	1,442	1,142	769
GLBENCHMARK EGYPT 2.5 HD OFFSCREEN (FPS)	15	17	16
CF-BENCH	6,543	13,646	13,342

SUNSPIDER: LOWER SCORES ARE BETTER

to battery savings. Even during more casual use, we'd have to plug it in after around 10 hours' use. Be prepared to have a charger close at hand.

There's no shortage of phones to pit against the One mini, but we settled for a competitor (Samsung's Galaxy S4 Mini) and the original HTC One running very similar software. The S4 Mini is powered by a faster-clocked 1.7GHz dual-core processor with 500MB of extra RAM, and it performed substantially better than the One mini on several of our benchmark tests. Still, as is often the case with synthetic benchmarks, other tests put the One mini ahead. In use, we found that the phone's responsiveness was mostly on par with the original One. It didn't take any more time to process video highlight clips or capture photos, despite the differences in hardware. Browsing the web on Android phones in recent years has become a more consistent experience; indeed, the One mini gave us swift page

loads and responsive scrolling even on media-heavy sites.

The mini packs the right LTE bands for EE in the UK (Band 3) while also including tri-band HSPA on this European model (900 / 1900 / 2100), offering speeds of up to 42 Mbps down. In speed tests on LTE, we logged downloads just short of 10 Mbps, with uploads reaching about the same speeds, if not better. Voice calls were also clear, and the secondary mic helped to dampen background noise when we were using the One mini as, well, a phone.

## WRAP-UP

The HTC One mini is the most appealing non-flagship smartphone we've seen in a while. And that's saying a lot: there are more choices than ever, with recent screen and processor boosts now adding incremental improvements across the board. Ultimately, it all comes down to the pricing here. The One mini is a beautiful phone that feels and often handles like a top-tier







The mini stands tall against other mid-size phones.

model, even if it isn't quite as classy as the One flagship. In the UK, Carphone Warehouse has priced the One mini at £380 (roughly \$590), or free on contract at £27 per month. The bigger One costs only £100 more off-contract, or free from £33 per month. Is that a big enough pricing gap to win over discerning shoppers? Probably not.

All told, the mini still bests rival mid-weight phones in several ways, with

the similarly sized, similarly priced Galaxy S4 Mini making for an easy comparison. The One mini's 720p screen is way ahead of the qHD screen found on Samsung's Galaxy S4 Mini, while the build quality and styling is a cut above the competition. There are also the excellent camera and software additions HTC has made — all points in the One mini's favor. For most people, the drawbacks (no optical image

stabilization, IR blaster or NFC; lower screen resolution; and less storage) will outweigh the price saving compared to the original One, but the mini remains a strong phone in its own right. If only it were a little cheaper. **D**

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*Mat is an Associate European Editor who lives in the UK. He's a Liverpool supporter who enjoys obscure Japanese game shows.*

## BOTTOMLINE

## HTC ONE MINI

**£380**  
**(UNLOCKED)**  
**\$590 APPROX.**



## PROS

- Stylish, solid design
- Sharp, well-performing 4.3-inch display
- Great camera
- Impressive loudspeaker audio quality

## CONS

- Disappointing battery life
- A few features dropped from the original One

## BOTTOMLINE

The One mini proves that mid-range phones don't have to embarrass, with a capable camera, high-quality screen and a design that mostly stays faithful to the original One.

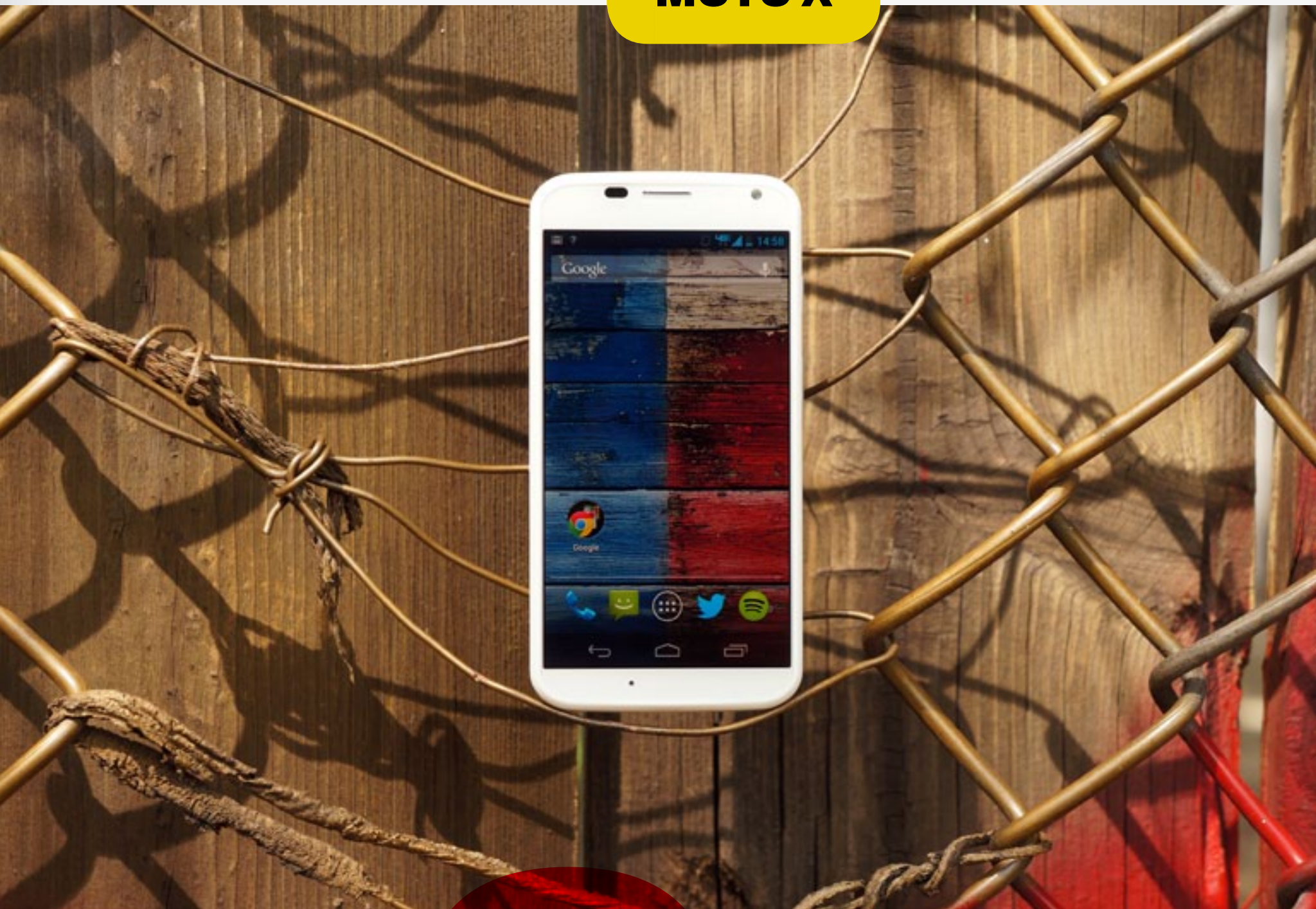




DISTRO  
08.09.13

# REVIEW

## MOTO X



The Motorola **Moto X** arrives with universal appeal, mid-range specs and build, and a host of new features, but will price and release limitations delay its adoption?  
**By Joseph Volpe**

**O**ne year ago, Motorola, fat and fed by its Google acquisition, inched quietly into a silicon-spun cocoon to gestate. The subsequent passage of time allowed it to transmogrify and re-emerge a thing of red, yellow, blue and sometimes green beauty; a Google thing made by a Google company. The Moto X, its newborn monarch, arrives in an array of different colors, made possible by the NikeID-like Moto Maker site. It also comes with a homespun narrative: it's assembled here in the USA. Time to empty your wallets, patriots. This is America's smartphone and it costs \$199 on a





two-year contract.

If I'm right in reading between the lines of Google's marketing speak, the Moto X was made in the image of the everyman. It's the product of a democratic process — you can take that future design poll on Facebook as proof of this point. The 4.7-inch screen size, the curvature of its back, the composite materials, its weight and front-face look were focus-tested for maximum inoffensiveness. The Moto X exudes no tech halo like the Galaxy S 4 or the HTC One because it is the sum of averages. Here's how I see it: You know those people who own iPhones, but don't know which model number they own and also refer to all Android phones as Droids? This phone is for them.

## HARDWARE

I've had the Moto X for five days now and the bond I've formed with it has nothing to do with its body. In the sea of tech products that litter my home, the Moto X is the least conspicuous — our eyes are never drawn to it. The woven white unit, a Verizon variant, is too plain-Jane for our tastes. It's unspectacular, but that superficial fail can be easily overturned by a visit to Moto Maker.

Having seen the litany of custom hues possible at the product's unveiling, we can assure you, the Moto X's beauty is truly in the eye of the prospective owner — a luxury sadly reserved for AT&T at launch. And just wait until you can get a wooden Moto X. As soon as Motorola's wood-backed prototypes pass testing and hit the market in Q4, I'm confident the Moto X'll become the "it" phone to have, the new black... the new-iPhone-that-isn't.

Motorola never specified just what materials make up the 130 grams that is the Moto X's composite shell, but you can safely eliminate Kevlar and metal (Droid staples) from that list. The backs of the woven white and black models have a trippy, Magic Eye-like effect, with a 10.4mm thickness that tapers to 5.6mm at the edges. Centered on the uppermost part of this backplate is the 10-megapixel ClearPixel rear

The size and tapered edges give this a good in-hand feel.



camera with an LED flash below and speaker grille to its right. Motorola's "M" logo lies just beneath in a circular depression that's acutely placed; here is where your pointer finger will naturally rest when holding the phone. From what we've seen of carrier-locked models, branding for each operator will appear towards the backplate's bottom end and nowhere else. Remarkably, it's even somewhat demure, as Verizon's silvery logo, and that of the AT&T models we've seen, has a way of fading into the background.

Quality craftsmanship isn't the first association that springs to mind when looking at the Moto X. The glossy white plastic that frames the device looks

chintzy. I use the HTC Droid DNA on a daily basis — a phone that also retailed for the same \$199 contracted price — and despite the obvious design similarities (curved back, blunt edges), the Moto X ends up looking like a Fisher-Price toy in comparison. But much like those toys made for toddlers, the Moto X also looks like it's prepped to endure hard knocks and drops. That precious woven white backplate, however, will get messy. I know because within *one hour* of owning the device, an innocuous rubber stand we'd used as a photo prop managed to scuff the backplate. No amount of soap, water or Clorox wipes were able to completely eradicate these dark black

You won't find carrier branding on the Moto X's front side.





scars. Keep that in mind when you're making your purchase. Like the bellies of swans, the white Moto X's backplate can get ugly pretty quickly.

The volume rocker and power button, both slivers of painted plastic on the device's right edge, are loosely secured and flimsy. They actually make a slight noise when you jiggle them in their sockets. I don't know about you, but when I plunk down \$199 and sign away two years of my life to a carrier, I want to know that the two buttons used most on a phone will be sturdy and everlasting. Which doesn't appear to be the case here. Moving on, smack dab atop the Moto X's sloping top edge, you'll find the 3.5mm headphone jack, while the nano-SIM tray, which requires a pack-in key (or paper clip) to open, occupies the left edge and, finally, the micro-USB port lies at the base.

Remember the "edge-to-edge" claims Motorola made with the Droid RAZR M? The Moto X is launching with nary a mention of that jargon. But Motorola's Rick Osterloh, SVP of Product Management, did tell us that 70 percent of the device's front face is all screen. And with the Moto X's reliance on Android soft keys for navigation, that particular boast

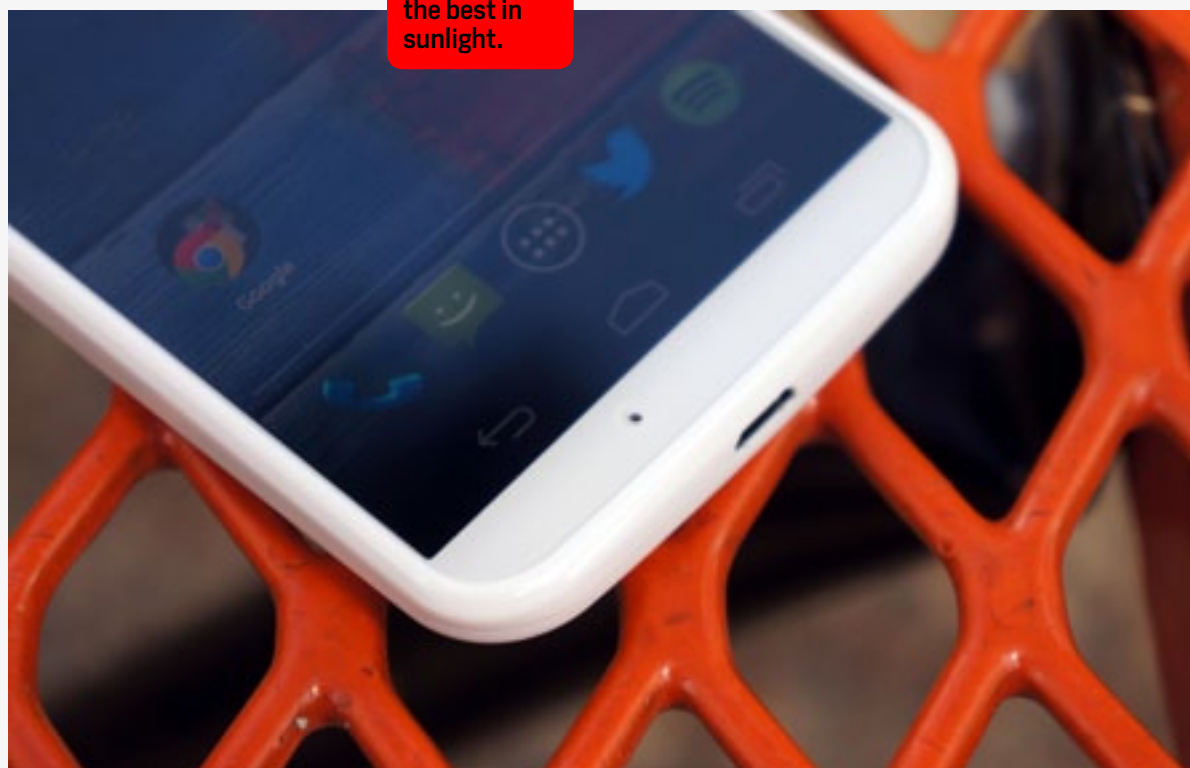
is unsurprising. Head-on, the Moto X is anonymous — save for a 2-megapixel camera, earpiece and ambient sensors up top, all branding has been stripped from it, thankfully. Neither you, nor we need to be constantly reminded of the manufacturer and carrier when staring at our phones. Buying the phone, using it on a daily basis and paying the monthly wireless bill are reminders enough. So kudos to Motorola for avoiding that stamp of corporate insecurity.

## DISPLAY

Yes, 1080p panels make for great bullet points in device announcement posts and headlines — even as talking points in podcasts. But let's be real, for those folks that don't pretend to know the difference between AMOLED and Super LCD 3, 720p is good enough and especially on a 4.7-inch screen. The Moto

X's AMOLED display packs a pixel density of 316 ppi,

While nice, the Moto X's screen isn't the best in sunlight.



looks great from most any angle and has that signature vibrant pop of saturated color associated with this panel type. In short, I like it and you will, too. That said, it's not the brightest display I've ever seen on a smartphone, and the glaring light of a bright summer sun does make it difficult to discern on-screen content.

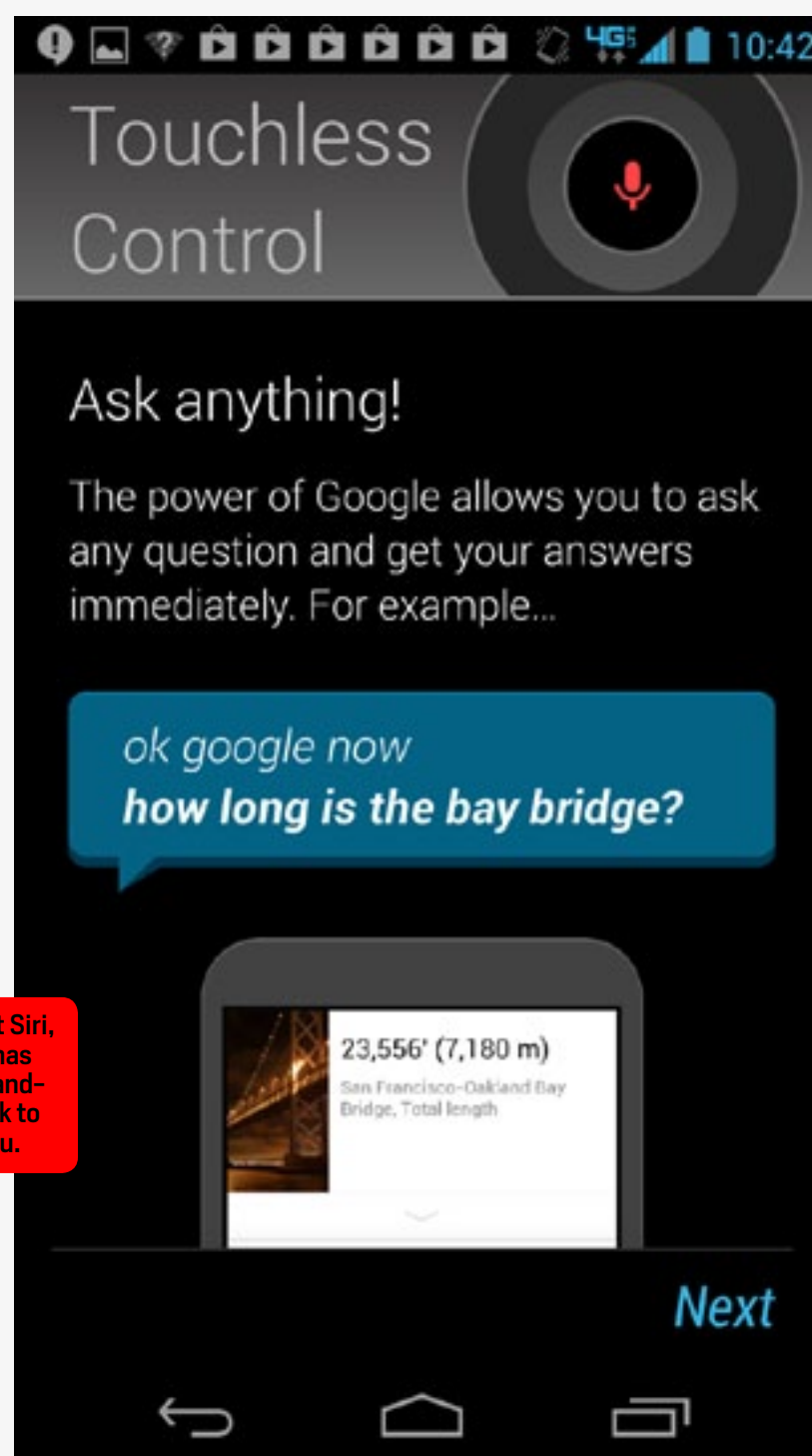
## SOFTWARE

When you first power on the Moto X, you'll be treated to the *new Motorola* boot animation; one where the "M" logo is its own world, literally. A couple of things are presented to the user before delving into the typical Android sign-in procedure. First, users will be allowed to opt-out of data collection and then they're prompted to take advantage of Moto Migrate, a new tool that requires the installation of a similarly named app on your soon-to-be-former smartphone for data migration. We've yet to test this tool because we prefer a virgin experience with any new smartphone and an unfettered view of any existing app bloat.

Despite being the product of a Google company, the Moto X does not ship with Android 4.3 out of the box, nor is it immediately receiving that over-the-air update like its Nexus brethren — perhaps the confirmed Google Play edition will. Instead, it comes with an *almost pure* version of Android 4.2.2 Jelly Bean. It's not lightly skinned in the way last

year's Droids were, what with their use of different icons throughout. Jelly Bean on the Moto X looks near identical to stock Android. It's the minor customizations Motorola's made to the camera UI, notifications and always-on voice commands that separate this from the Nexus line; tweaks you'll wish Google would carry over to stock.

Among these tweaks, our favorite, and what should be considered Motorola's new killer Android feature, is Active



Look out Siri, Moto X has got a brand-new trick to show you.

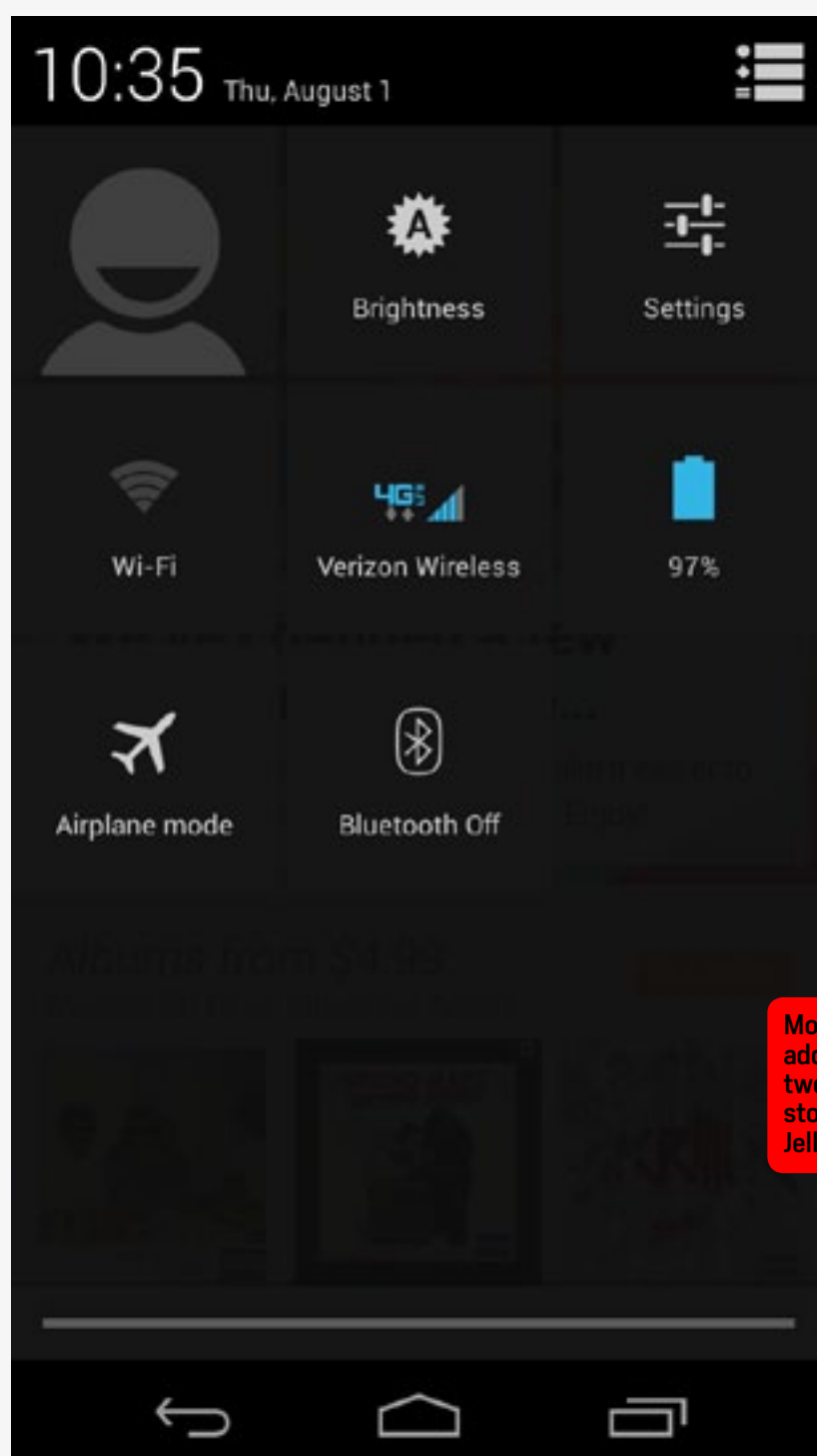




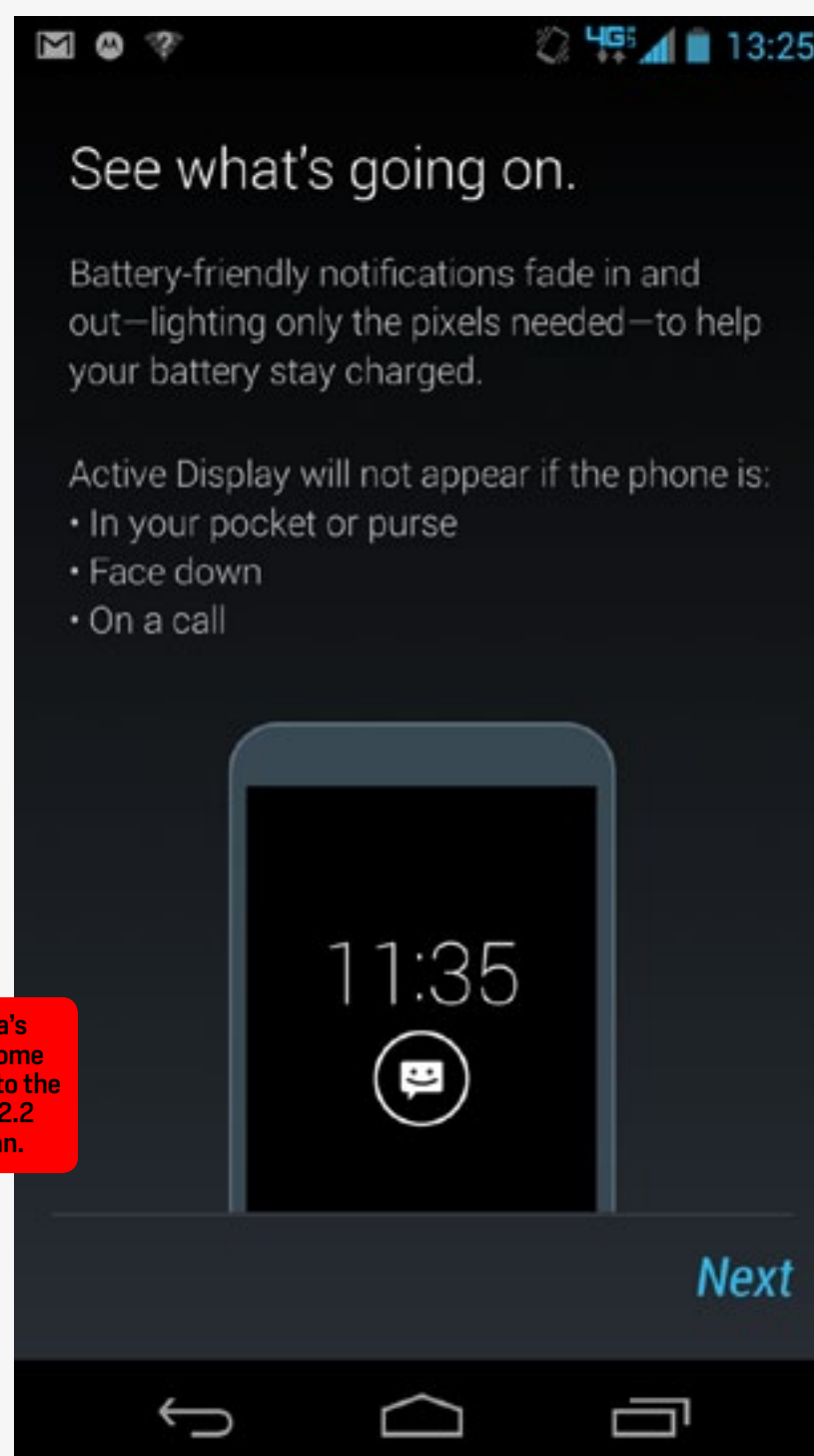
**Display.** This is, in a sense, what makes the Moto X *smarter* than your average smartphone and one of the reasons Motorola developed that specialized contextual computing core. Pull the phone out of your pocket and a portion of the display immediately illuminates with the time, any new notifications and an unlock icon. You can even preview those lingering notifications by tapping the blinking icon onscreen and then fully access them by sliding your finger

upwards. Not to worry, you can manage which notifications show up, when they do or even prevent them from displaying altogether when using password protection in this sleep mode — called a “breathing cycle,” since it fades on and off once triggered. Active Display can also be initiated by flipping the phone over, specifically if it’s been face-down on a table while you’re at a meeting or eating out with friends.

I haven’t really found much use for



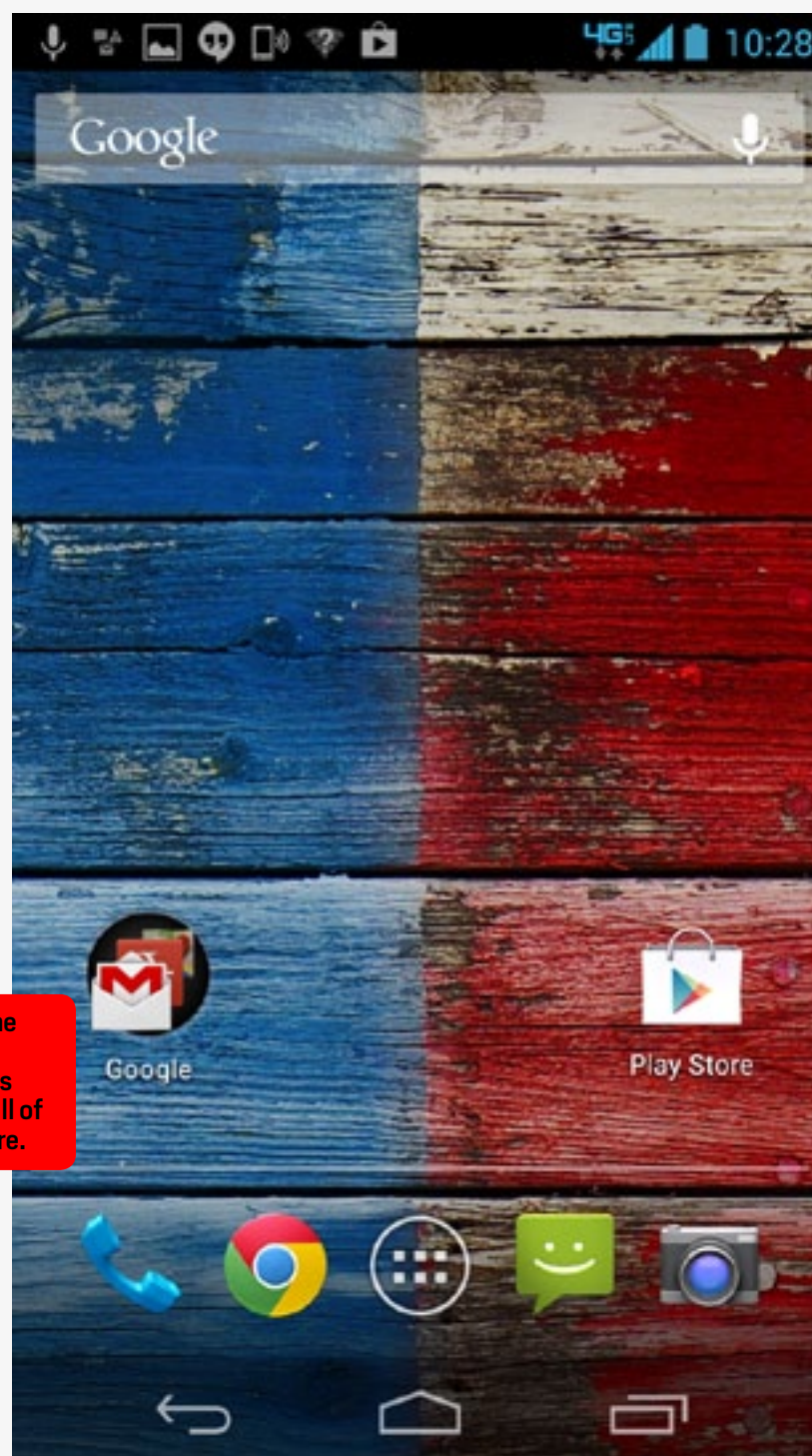
Motorola's added some tweaks to the stock 4.2.2 Jelly Bean.



Touchless Control, the always-on voice recognition feature launched by saying, “Okay, Google Now.” I’m sure there will be instances where I’m otherwise occupied and will need to shout at my phone for assistance, but it still seems to me a gimmick. One thing’s for sure, you won’t ever have to worry about friends, family or pesky strangers accidentally launching the feature. There’s a three-step personalization process when you first start it up to prevent that and it’s kind of foolproof. Trust us, we tried to trick it with the voices of various friends to no avail. So, what can it do? You can instruct it to place calls, get directions, launch apps, send texts, set alarms and reminders, ask questions and even play music (through Google Play Music). I’ve gotten particular amusement out of asking it, “Who is Jennifer Aniston?” and then listening to the robo-voiced reply.

I’ll circle back to Quick Capture, the last of Motorola’s custom tweaks, in the camera section. For now though, let’s explore the other aspects of Android 4.2.2 on the Moto X, like bloat. Because, yes, it’s on there and, yes, it’s Verizon’s fault. Apps like NFL Mobile, VZ Navigator, Voicemail, Verizon Tones, Quickoffice, My Verizon Mobile, Mobile Hotspot and Caller Name ID all live on the Moto X. (Ugh is right.) What’s more, none of it can be uninstalled, only disabled. (Ugh, ugh.) These are in addition to Migrate and Assist, Motorola’s duo of actually useful

pre-installed software. We’ve already detailed the purpose of Migrate, so let’s talk about Assist. The app backs up Osterloh’s promise of a “smarter phone” that’s contextually aware. Case in point, if you want to enable driving mode, which uses the accelerometer and GPS to detect when you’re behind the wheel and then reads your texts and phone calls out loud, you’ll need to set up Assist. The same goes for silencing notifications during meetings or keeping the phone quiet at designated



Sadly, the Verizon version is chock full of bloatware.





times while you sleep. Buried in display settings, advanced users will also find an option for Wireless Display. This function uses Miracast to mirror the phone's content on compatible displays and can be toggled on or off.

## PERFORMANCE

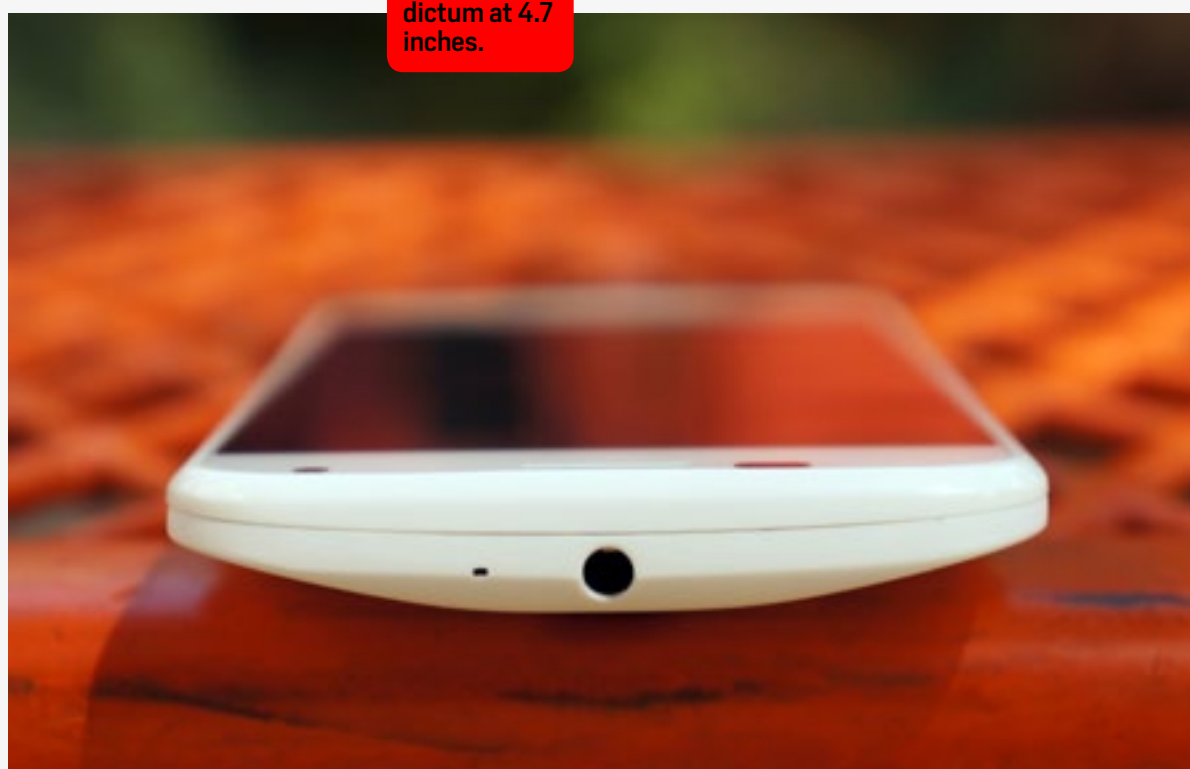
Don't call it an SoC because it's not. The X8 custom architecture Motorola's embedded within the Moto X (and new Droid line, as well) is a combo of a dual-core Snapdragon S4 Pro clocked at 1.7GHz, a quad-core Adreno 320 GPU and two specialized cores — one for the aforementioned contextual computing, the other for natural language processing — plus 2GB of RAM. Those latter two custom cores were made specifically to enable optional features like Active Display, Quick Capture and Touchless Control to function in a low-power state. That means that even when your screen's off, these features are only a flip, wrist twist or voice command away. I'll be honest, it does take some getting used to, seeing your display illuminate and then wondering / worrying about the hit on battery life. So far, that 24-hour battery life claim has proven true and that's *without* the battery saver option turned on.

Lately, the smart-

phone buzz has centered on processors like the Snapdragon 600, or 800 — burly quad-core CPUs that translate into nimble performance. Throw something like the mutant X8 into the mix and you're left with confused spec-freaks that don't know how to compare the length of their swords. All we have now is real-world performance. Sure, the requisite benchmark testing is part and parcel of this review, but with recent allegations of rigged results, I'm more inclined to lean on my personal experience as a yardstick and not a chart of numbers.

It was Steve Sinclair, VP of Product Management at Motorola that referred to the Moto X, more than once, as being "butter smooth." He was, of course, alluding to Project Butter, the 60 frames per second made possible by Jelly Bean. And he was right, the Moto X does glide along in every action. The transitions are smooth and the app launches are seamless; noth-

The Moto X eschews the big-screen dictum at 4.7 inches.



BENCHMARK	MOTO X	MOTOROLA DROID ULTRA, MAXX, MINI	SAMSUNG GALAXY S 4 (T-MOBILE)	HTC ONE (GLOBAL)	NEXUS 4
QUADRANT 2.0	8,958	8,775	12,684	12,495	4,949
ANTUTU 3.X	18,585	18,553	26,143	25,140	16,294
SUNSPIDER 0.9.1 / 1.0 (MS)	1,030 / 1,023	844 / N/A	772 / 723	991 / 630	1,975 / 1,016
CF-BENCH	14,092	14,357	28,111	25,267	13,954
GFXBENCH 2.7	42	N/A	16	15	13
VELLAMO	2,427	N/A	1,903	2,429	1,382

SUNSPIDER: LOWER SCORES ARE BETTER.

ing about its performance is herky-jerky. Take our word for it. We're what you'd consider heavy users, with tons of tasks living in the background at any given moment, and we've yet to witness the Moto X flinch. It's that good. It also never heats up in hand. Thank you, Motorola.

Alright, let's move on to benchmarks. Take a look at the chart and you'll see there's not one clear Android rival for the Moto X. Its \$199 on-contract price is the sole commonality between it and current Android kings: the Galaxy S 4 and HTC One — Google's Nexus 4 is the lone outlier. Pitted against those two top-tier smartphones and their Snapdragon 600 hearts, the Moto X just can't keep up. It is, by virtue of that X8, comparatively slower, although graphics performance seems to run rings around its rivals, despite all four sharing an Adreno 320 GPU. Contrast it with the Nexus 4's Snapdragon S4 Pro and you're looking at a

fairer fight, but, again, graphics scores outpace Google's reference device.

## BATTERY LIFE

As I write this, my Moto X is still carrying a 28 percent charge after one day, two hours, 12 minutes and three seconds. To give you a better idea of how I arrived at this number, allow me to explain my personal usage habits. Spotify is nearly always running on my phone when I'm in transit, which, here in New York City, means almost any time spent not sitting. When I'm idling, I usually launch Pocket to catch up on news, voraciously refresh and scan Twitter (set to sync every 15 minutes), have constant emails pouring in and out that I read and respond to, Hangouts that I periodically indulge in, Maps for rushing off to various meetings around town and Chrome for the 20-plus links I have open at any given time.

It's sad, but I am that person at dinner or drinks who's always staring at his





phone. And that sort of behavior nets you a 28 percent charge on the Moto X after one day, two hours, 12 minutes and three seconds without battery saver enabled. That result bests even Motorola's own conservative claim of 24-hour battery life. Under the strain of Engadget's formal battery run-down protocol, in which an HD video plays on a loop, the Moto X's 2,200mAh cell lasted 11 hours and 15 minutes. Clap your hands, people. This is the battery life you didn't know you were missing.

## CAMERA

I'm not a cameraphone person — never have been and never will be. I just don't feel compelled to snap and share photos as much as everyone else on planet Earth. It's that quality that makes me the perfect test case for the Moto X's pared-down camera UI and Quick Capture feature. According to the company, users will be able to wake the phone into camera mode via a wrist-twisting gesture and then capture photos in just under two seconds. There's no dedicated dual-detent hardware key to press, nor is there a software shutter button. You just tap anywhere on screen and the 10-megapixel ClearPixel camera snaps away. And if you continue to hold your finger pressed to the glass, it'll keep on shooting (much like

a burst mode) and record the number of images with an onscreen counter. Since autofocus and exposure are automatically handled, the Moto X's camera is basically idiot-proof. You don't need to know what an ISO is or worry about white balance. HDR is even set to auto by default. All that said, you will need to give the RGBC sensor time to adjust to a scene before you snap away. Quickly grabbed shots will often appear out of focus and in low-light conditions, moving objects will appear extremely blurry.

So, what is a ClearPixel and why should you care? Simply put, it collects more light and takes better pictures on the fly. On a more technical level, the f/2.4 lens and 10-megapixel sensor inside the Moto X's rear camera module gathers up to 75 percent more light than a typical RGB sensor, making it great for low-light performance and overall faster exposure times. But, like I mentioned before, you can't just tap and snap immediately; you have to al-

Given a moment, it can capture great, mixed-light shots.



low the Moto X to adjust. Otherwise, you wind up with a widely varying exposure and soft-focus shots.

Speaking of focus, you can enable tap-to-focus from within the left-side slide-out settings wheel, in addition to setting toggles for HDR, flash, Quick Capture, slo-mo video, panorama, geo-tagging and shutter tone. And now, a word about the Quick Capture gesture. It's really fun to use once you get the hang of it. I'll be forever grateful to the Motorola rep that explained the motion to me as "turning a doorknob back and forth." Because, that's the exact motion you need to emulate to get it working. I've let many a friend and family member test it out using that explanation and the resulting reaction has been unanimous: people love it. Sure, it'll garner you some stares from passersby, but who among you doesn't want to show off their newly acquired mobile kit?

The 16:9 shots I captured in my downtown New York City walkabout are vivid and crisp, but that's because they were mostly taken within a shallow depth of field. Move out of this and you'll start to lose detail. Color reproduction on the whole is natural, but that also depends on the exposure — it can be hit or miss. Macro shots came out in great detail, but the same cannot be said for fully zoomed-in shots. There's just too much loss of detail there to be workable (a Lumia 1020, the Moto X is not). Also, 1080p video recorded on the Moto X is good, not great. The AF adjusts as you move the camera, but in our test video, frame rates for

nearby moving objects were bizarre and resumed normality as the object moved out of range. Audio playback was pretty clean thanks to the three noise-canceling mics placed around the device.

## THE COMPETITION

Motorola won't reveal the Moto X's off-contract pricing — not yet, anyway — which leaves us with a \$199 on-contract mid-range device. That's unfortunate because the Moto X would've been better served by a price of \$99, a typical MSRP for a mid-range device. Oh well. Since Motorola's positioned its hero device in the big leagues, ostensibly forcing consumers to choose between it and similarly priced mega phones — the GS4 and HTC One — here's how that rivalry shakes down.

For \$199, both the GS4 and One will get you a 1080p display (screen size varies from five inches to 4.7 inches, respectively), Snapdragon 600 CPU, 2GB of RAM and some version of Android 4.2 Jelly Bean. Where those two handsets differ is in memory allotment: the One comes with a non-expandable 32GB of internal storage, whereas the GS4 packs 16GB standard plus up to 64GB via microSD expansion. Or, for something a little less robust, you can go the Nexus 4 route and spend \$299 outright. That'll get you considerably less storage, only 8GB, but a screen size similar to the Moto X, a Snapdragon S4 Pro processor, the same amount of RAM, as well as access to the absolute latest version of Jelly Bean (4.3). As an alternative to An-






droid, there's always the 16GB iPhone 5 for the same on-contract pricing. What you gain in ease of use and ecosystem, however, you trade-off in size: the iPhone 5's Retina display is four inches — a dwarf by today's standards.

## WRAP-UP

I like the Moto X. I really, really do. It's the smartest smart object I'm currently carrying on my person and I'm too used to that Active Display to calmly resume life with my DNA. That affinity, however, doesn't necessarily mean I'd buy it if given the chance. The price is just too darn high for what's on offer. In a market where phones with higher-res displays, greater storage and faster processors are a mouse click away for \$199, the Moto X just can't compete.

But that prognosis changes dramatically when you factor in Moto Maker. I'm almost confident that the Moto X would

be a runaway hit (\$199 price be damned) if Moto Maker were a standard option for all five US wireless carriers. That it isn't is troubling and, for now, only AT&T subs will have access to the NikeID-like customizations come launch. And then there are the wood-backed Moto X variants coming this Q4, the tantalizing promise of which could keep consumers from buying in now. I like where this new Motorola's going: the personalization, the few, focused user-friendly enhancements, the stellar battery life and crowdsourced design. If only its launch execution were a bit smarter like the Moto X, a bit tighter (that wood option should've been ready) and a bit more accessible (Moto Maker for all!), regardless of carrier. Motorola, let this butterfly fly free. 

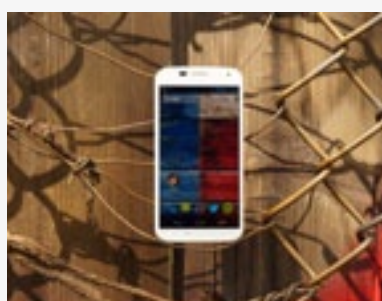
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*Joseph Volpe is ambiguously ethnic. He is also a Senior Associate Editor at Engadget.*

## BOTTOMLINE

### MOTOROLA MOTO X

**\$199**  
(ON CONTRACT)



### PROS

- Long battery life
- Useful Active Display notification previews
- Easy to activate Quick Capture mode
- Smooth overall performance

### CONS

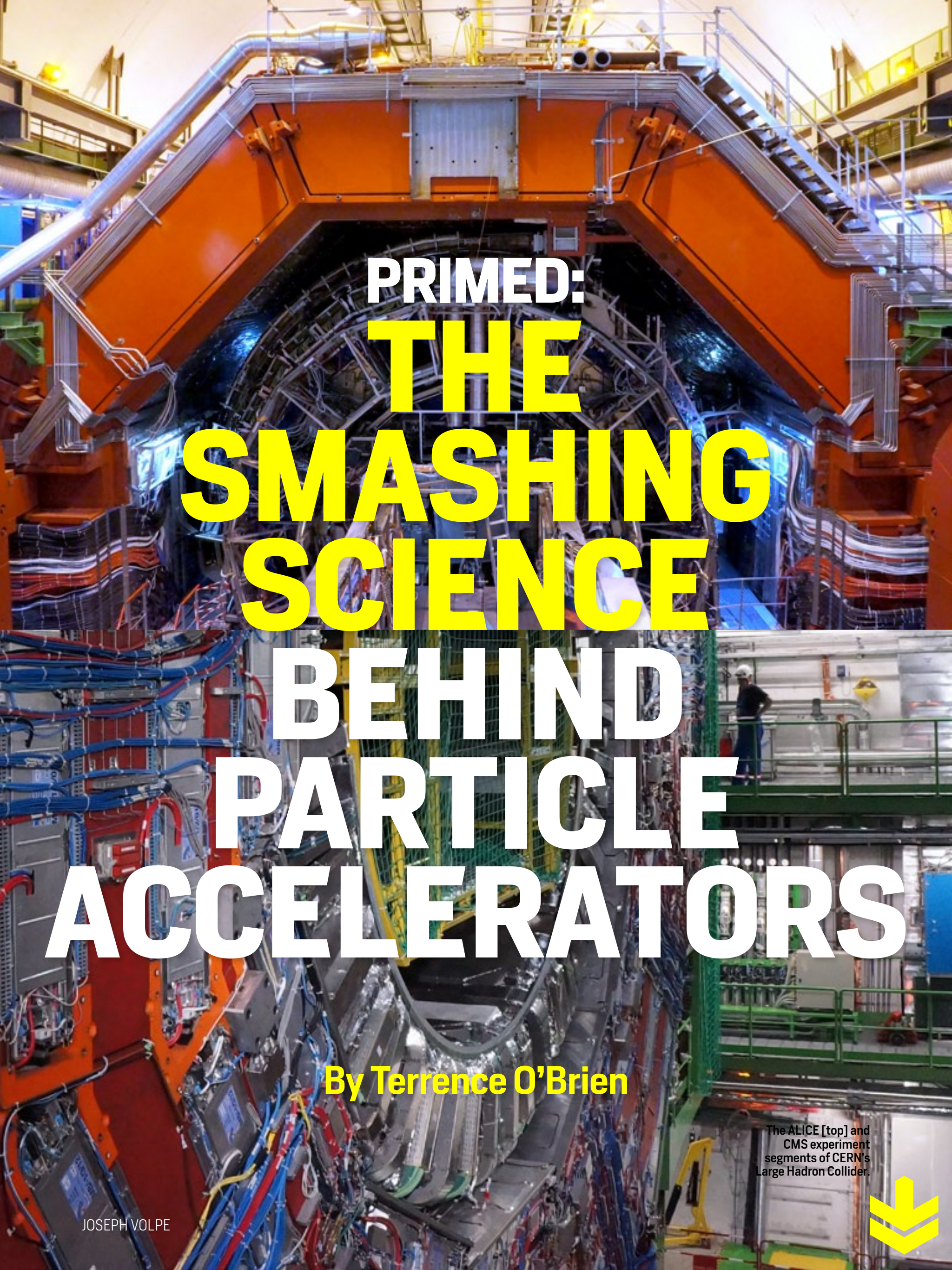
- Moto Maker restricted to AT&T
- On-contract pricing should be lower

### BOTTOMLINE

The Moto X hits a sweet spot with its user-friendly, always-on software features. At \$199, though, it's priced a bit too high for a mid-range phone.







# PRIMED: THE SMASHING SCIENCE BEHIND PARTICLE ACCELERATORS

By Terrence O'Brien

JOSEPH VOLPE

The ALICE [top] and  
CMS experiment  
segments of CERN's  
Large Hadron Collider.





Long before the Large Hadron Collider (LHC) could smash its first atoms, researchers manning the Tevatron collider at Fermilab, in a quiet suburb 40 miles west of Chicago, raced to find evidence that the Higgs boson exists. After roughly three decades of service, the Tevatron shut down for good in late 2011, dealing the city of Batavia's largest employer a significant blow. Less than 18

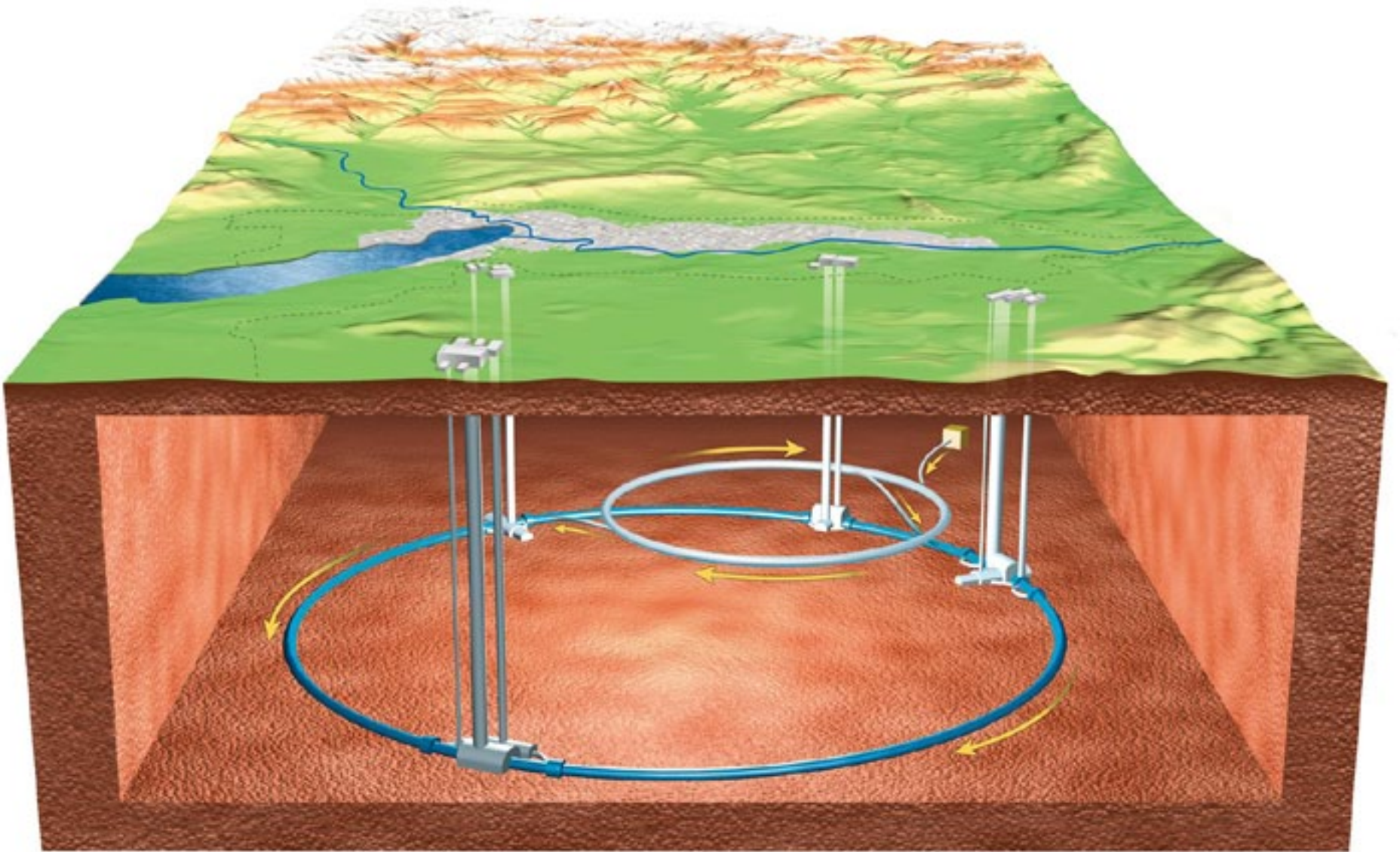
months later, the LHC (the Tevatron's technological successor) also went offline — albeit temporarily. Only four years after recording its first proton collisions, the team at CERN is already scrambling to upgrade the staggering LHC, which lies under parts of no less than five cities in both France and Switzerland. With the world's largest particle colliders smashing a whole lot of nothing together for the next two years at least, the field of high-energy physics research is starting to look resource-starved. Of course, many might ask why exactly we need giant atom smashers like this, or even how they work. It turns out that first part is quite a bit easier to answer than the second.

During the last several decades, particle accelerators have revealed the existence of elementary particles such as quarks, led to the discovery of antimatter and generally helped us unlock the mysteries of the universe. And once they were done splitting atoms and probing the darkest corners of theoretical physics, accelerators often led to breakthroughs in medical imaging and cancer research. So, as massive colliders seem ready to land on the endangered species list, it seems as good a time as any to explain what a particle collider is, how it works and what we as a society have to gain from the research.

## WHAT IS A PARTICLE COLLIDER?

Well, let's start a little broader, since a collider is actually just a particular subcategory of devices called particle accel-



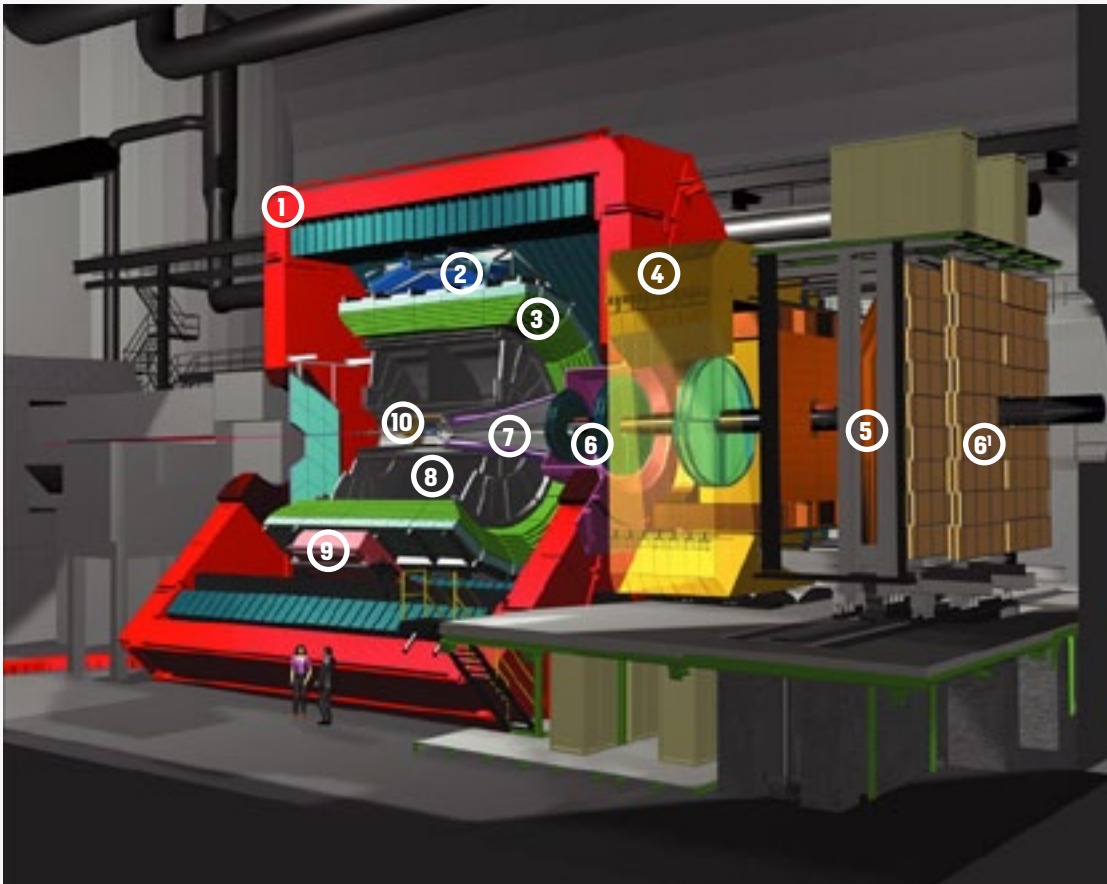


A computer-generated schematic of the LHC's 27km subterranean tunnel [blue] with vertical shafts at each of the four main experiments (ALICE, ATLAS, CMS and LHCb).

erators. So, what exactly is a particle accelerator, you ask? It's more or less exactly what it sounds like: a device that propels charged particles at high speeds. Accelerators come in a variety of sizes, from the cathode ray tube in your grandparents' TV to the 17-mile-long Large Hadron Collider, but they all operate in basically the same way: an electromagnetic field fires particles (anything from hydrogen atoms to electrons or protons) in a concentrated beam. To build that momentum, the device can use either a static field (like the CRT) or an oscillating field, though the former is severely limited in the amount of energy it can generate without producing an electrical discharge. By using multiple, oscillating, lower-voltage sources, an accelerator is able to put much more oomph on a particle beam and approach the speed of light. Modern colliders use a special type of vacuum tube called a klystron to generate these waves of energy that push the particles along. These are actually souped-up versions of the same tubes that powered radar equipment for the Axis during World War II.







Diagramming ALICE (A Large Ion Collider Experiment), one of the four main experiments of CERN's LHC.

1. L3 MAGNET
2. HMPID
3. TOF
4. DIPOLE MAGNET
5. MUON FILTER
6. TRACKING CHAMBERS
- 6'. TRIGGER CHAMBERS
7. ABSORBER
8. TPC
9. PHOS
10. ITS

Electrostatic accelerators are also limited to firing particles in a straight line, while ones powered by oscillating fields can curve the path of the beam with the help of magnets. In the case of facilities commonly called “atom smashers,” those beams are set on a collision course with a target, be it stationary or a second stream of accelerated particles. When the particles hit

their target, they release a massive amount of energy and throw off smaller component parts of themselves, such as quarks, the sub-subatomic particles that make up protons and neutrons (more on that later). A collider, specifically, is actually comprised of two accelerators built on top of one another that intersect at various points along ring-shaped tracks that guide the particles. Where the beams cross and the particles collide (hence the name), there are large detectors, several stories high in some cases, that record the subatomic wreckage and offer us a glimpse into physics at the smallest of scales.

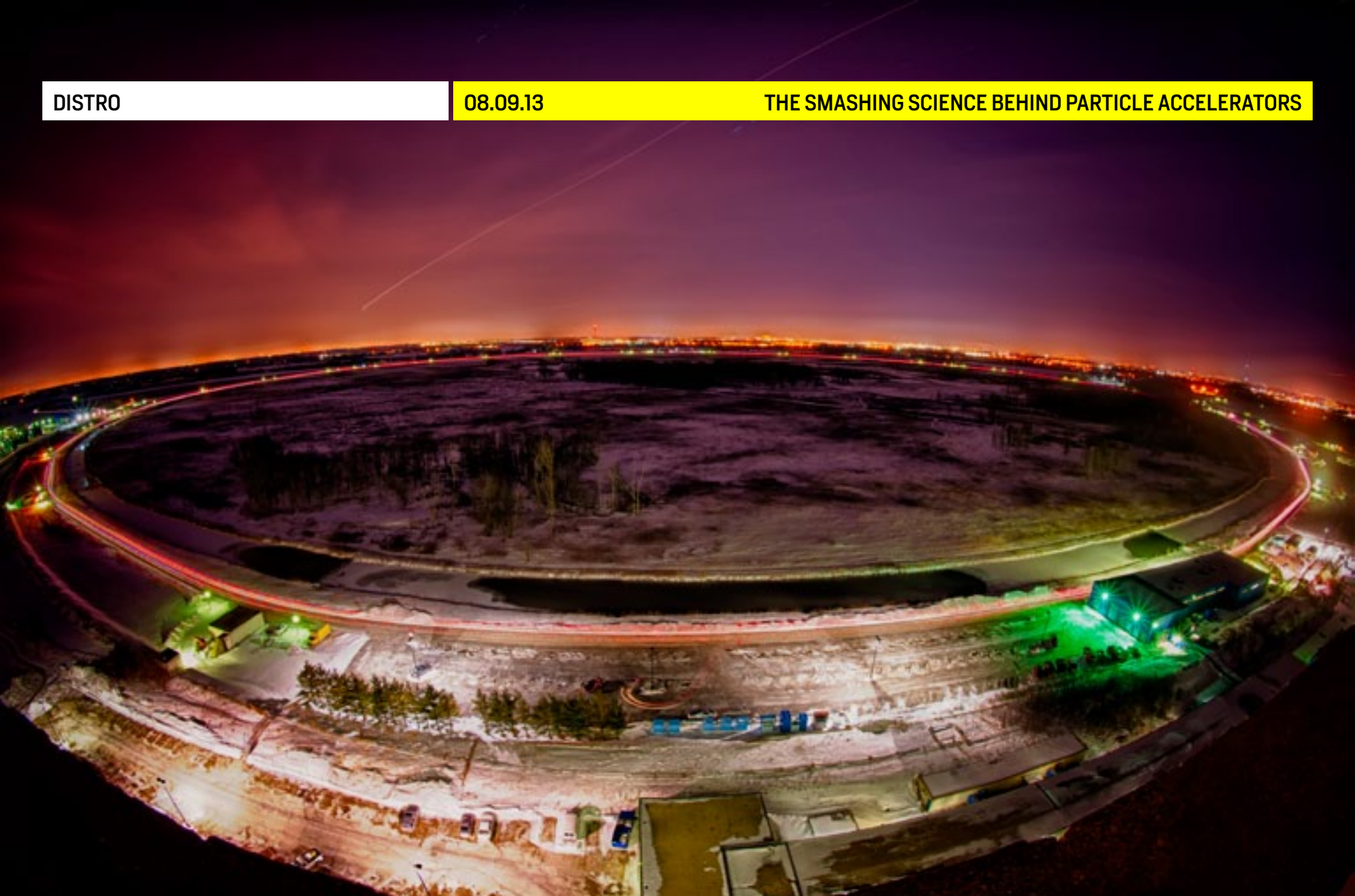
These high-energy physics laboratories make up only the tiniest portion of active accelerators in the world, however. Of the tens of thousands of particle accelerators around the globe, most are built for ion implantation (often used in manufacturing semiconductors) or radiotherapy (used in the treatment of cancer). In fact, according to CERN, almost half of the particle accelerators in the world are used for medical purposes.

## GAINING SPEED

Accelerators basically come in two different shapes: linear and circular. In a linac (short for linear accelerator), there







Vibrant nighttime and dusk views of Fermilab's 4-mile-circumference Tevatron accelerator, which began service in 1983 and operated for 28 years until it was shut down in 2011.

is only one chance to accelerate a particle to the desired speed. Since the beams travel in a straight line, the only way to make a particle travel faster is to crank up the en-

ergy or build a longer accelerator. Single-pass devices of this kind have their limitations, most obviously their need to have long stretches of continuous space available for construction. That's why the modest (and now shuttered) 4.26-mile-long, ring-shaped Tevatron dwarfs even the largest linear accelerator in the world, the 2-mile-long SLAC Na-





tional Accelerator Laboratory.

There are actually many different varieties of circular accelerators. These use magnetic fields to control the trajectory of the beam, passing them through an acceleration chamber over and over again, gradually increasing the speed of the particles inside. The earliest was the cyclotron. Developed in 1929 by Ernest Lawrence at UC Berkeley,

An early cyclotron designed by American physicist Ernest Lawrence, circa 1932.

a cyclotron houses a pair of D-shaped magnets that accelerate a charged particle in an expanding orbit. A rapidly alternating current is applied to the magnets, which guides the particle in a growing spiral towards whatever the target happens to be. Although there are still some cyclotrons in service for research purposes, most are used for radiation therapy or PET scans.

In modern high-energy physics research, synchrotrons like the LHC are much more common. Instead of accelerating outwards from a central source, particles in a synchrotron are fired around a ring in a consistent track. This allows the particle to be ac-





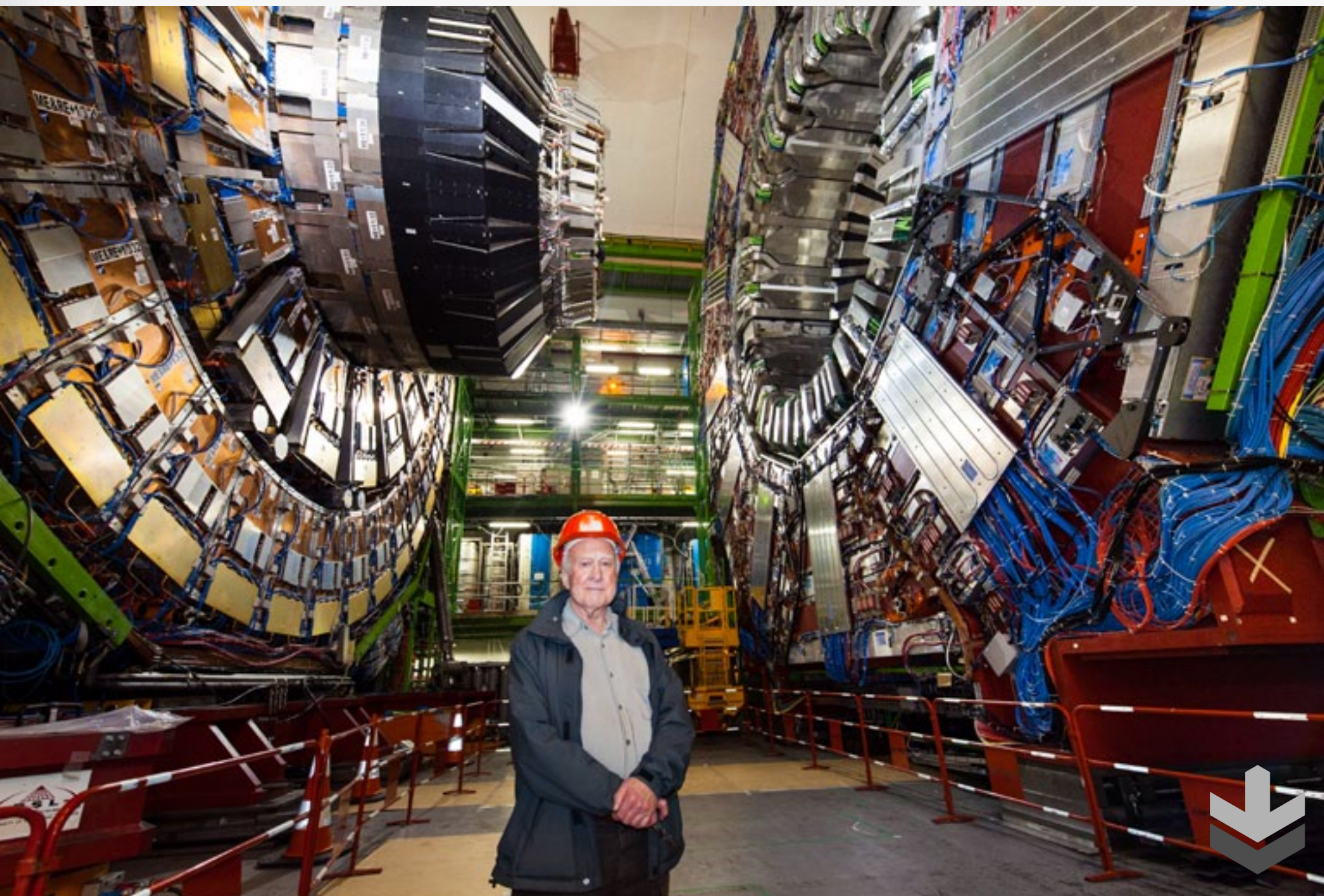
celerated indefinitely... at least in theory. As the particles approach the speed of light, the forces of relativity begin to act on them and they lose energy through radiation. The faster they go, the more radiation is generated. This synchrotron radiation can pose a problem for physicists simply looking to create the most powerful beam of particles possible, but it turns out that this is actually a useful source of X-rays, which can be manipulated to act like a microscope.

## INSIDE THE LHC

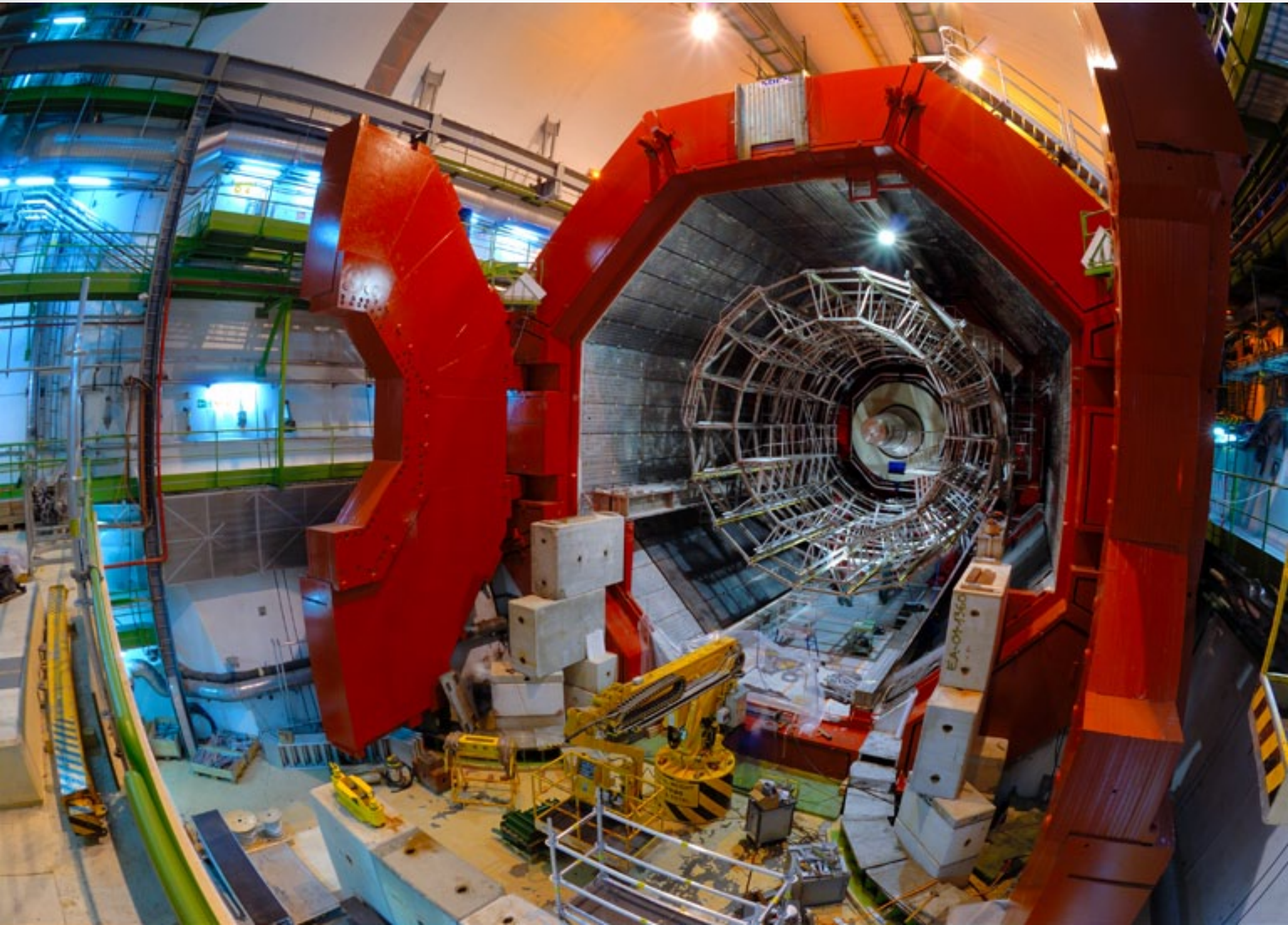
Perhaps the best way to understand how these devices work is to take a detailed look at one. And what better accelerator to use as an example than the world's largest and most powerful, the Large Hadron Collider? Protons race around the 17-mile track in opposite directions at 99.9999991 percent the speed of light, performing more than 11,000 complete laps every second. These protons

Professor Peter Higgs, after whom the Higgs boson particle was named, visits the CMS experiment section of the LHC.

CERN







The ALICE absorbers and surrounding structures — totaling three main sections and weighing an aggregate 400 tons — were precisely aligned at a tolerance of 1-2 mm.

don't just materialize inside the main ring. First, scientists must generate them by filling a cylinder with hydrogen and stripping away the electrons. Then the newly freed protons begin a long journey through several smaller accelerators, starting with the Linac 2. From there, they then pass on to the Proton Synchrotron Booster, the Proton Synchrotron and, finally, the Super Proton Synchrotron (SPS), a process that gradually pushes their energy levels towards 450 GeV (gigaelectronvolts) before entering the collider. The protons aren't simply spat out in a constant stream either. The SPS releases the particles in bunches, equally distributed between each track, traveling in opposite directions. This is to ensure that collisions





happen at regular, predictable intervals.

Now, the other parts are essential and impressive feats of engineering in their own rights, but it's the collider itself that deservedly garners the most attention. The primary beam tube straddles the borders of France and Switzerland at a minimum depth of 160 feet, crossing back and forth between the countries four times. As the accelerator cranks up the speed, pushing the protons towards 7 TeV (teraelectronvolts), more than 1,600 magnets (most topping 27 tons) steer the subatomic particles. Those powerful magnets need to be chilled with liquid helium to a rather frosty 1.9 degrees Kelvin (about 456 degrees below zero Fahrenheit). The “track,” as the researchers call it, which contains the proton beam is an extreme vacuum on the inside. In fact, there are fewer stray particles inside the track than there are in a similar volume of outer space. That vacuum is essential to preventing contaminants from colliding with the protons.

All of this hard work would be for naught without a way to actually study the subatomic flotsam cast off by the colliding particles. In total, the LHC ring houses seven experiments, spread out among four intersections, that seek to answer questions about the moments immediately following the Big Bang, why we live in a world composed of matter (as opposed to antimatter) and myriad other physics mysteries. At each of these points, the two separate tracks meet and magnets squeeze the beams together. Then, ignoring all advice from Dr. Spengler, they cross the proton streams, generating as many as 600 million collisions per second. The smashing of particles throws off gluons and quarks and all manner of exotic material while generating temperatures not reached since the moments after the Big Bang. The massive detectors at each site (ATLAS, CMS, ALICE and LHCb) use roughly 150 million sensors to record these fleeting events. For example, strange quarks (more on those later) decay into stable up or down quarks in the tiniest fraction of a second. These detectors obviously put out an absolutely massive amount of data — roughly 700MB per second, which is over a petabyte a month.

An overview of the LHC and the smaller pre-accelerator (both in blue), as well as the transfer lines that connect them (shown in red).





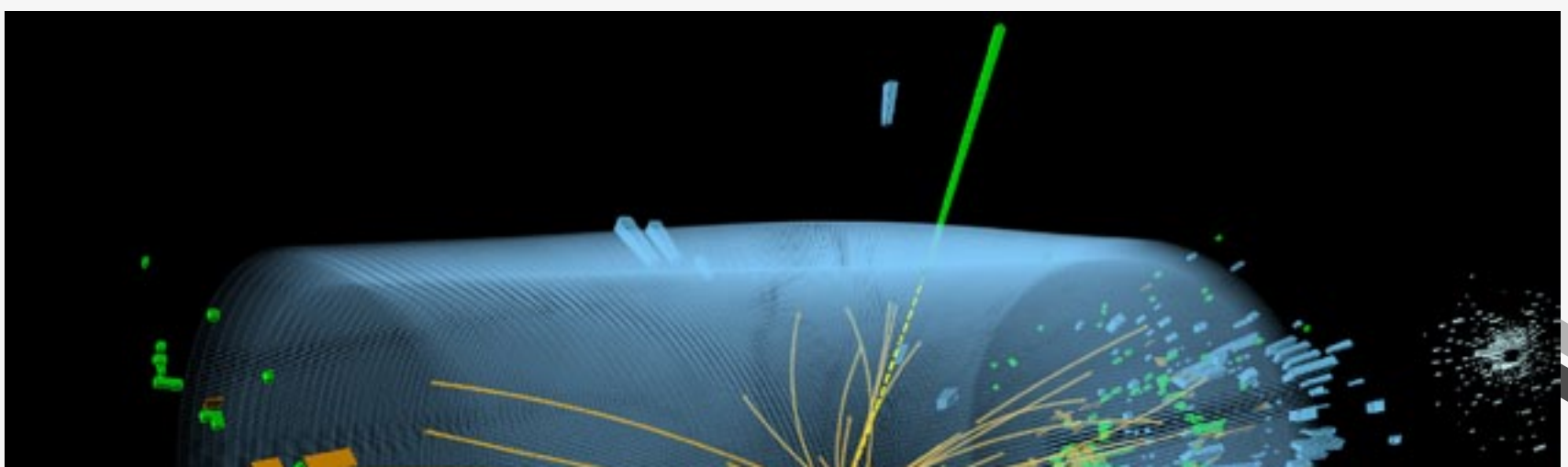
## THE MATTER WITH MATTER

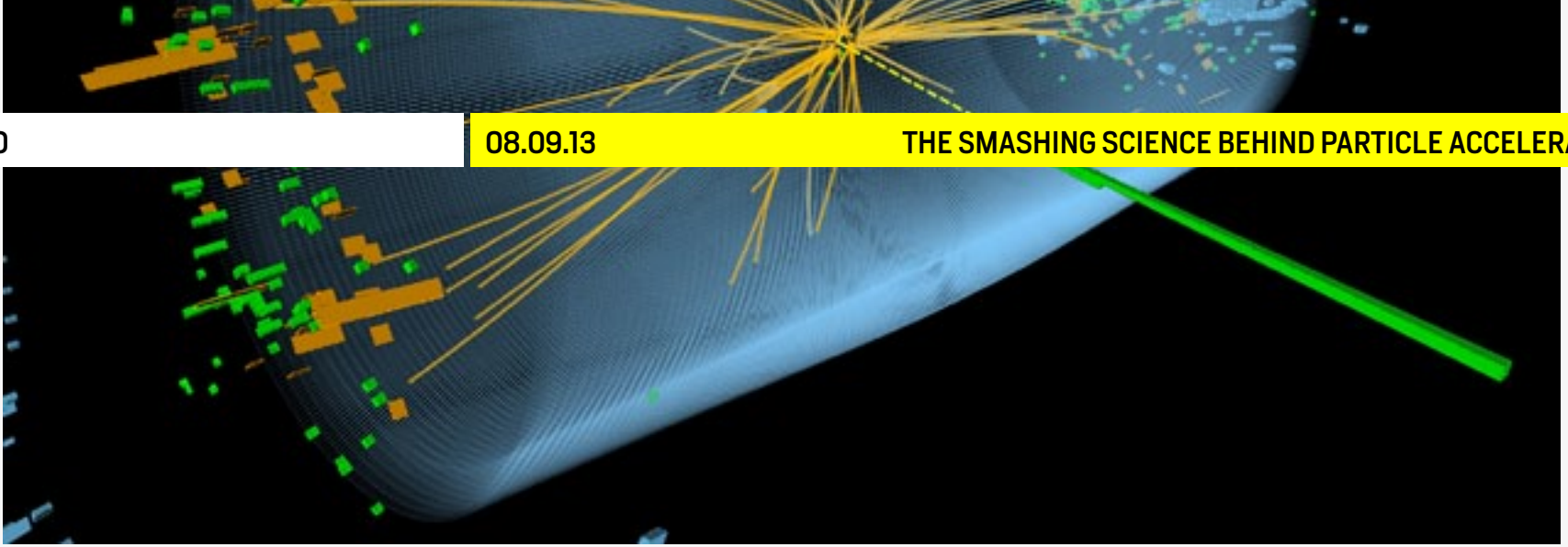
While fabricating semiconductors and fighting cancer are arguably more important and productive uses for particle accelerators, it's the atom smashers like the LHC that have captured the imagination of the public. This is partially thanks to a rather effective media blitz run by CERN, but also because of their scale and the potential to unlock the mysteries of the universe. After all, it's hard not to sit in awe of a marvel of engineering like the LHC, which, if uncurled, would be longer than Manhattan, or of the Tevatron, which used more than 1,000 magnets to steer beams of protons (clockwise) and antiprotons (counter-clockwise) in bunches many times smaller than a human hair. Those particles traveled at close to the speed of light into a head-on collision.

The exciting part is what happens when these particles do, in fact, smash together. In high school, you were probably told that matter was composed of atoms, and those atoms were composed of protons, electrons and neutrons, and that was it. In truth, protons and neutrons are hadrons, or composite particles, that are actually made up of even smaller constituents called quarks. When these subatomic particles collide at speeds approaching that of light, they generate intense amounts of heat and throw off quarks, including rare ones that don't often occur naturally in the universe and are given names like "strange" and "charm." Up and down quarks are more common and make up the vast majority of observable matter in the universe. Their more oddly named siblings decompose pretty quickly, stabilizing as either up or down.

Gluons are elementary particles that mediate the strong nuclear force between quarks. If that sentence makes your head spin a bit, don't worry, all you really need to know is that they're exchange particles, almost

An event recorded in 2012 within the CMS experiment, showing characteristics expected from the decay of the SM Higgs boson into a pair of photons (shown as yellow dashes and solid green lines).





like neurotransmitters in the human body, controlling the strong nuclear interaction simply by travelling back and forth. One of the major purposes of the LHC is to study quark-gluon plasma, a thick soup of these matter-building blocks that existed in the extreme heat and density following the Big Bang.

## HUNTING THE HIGGS

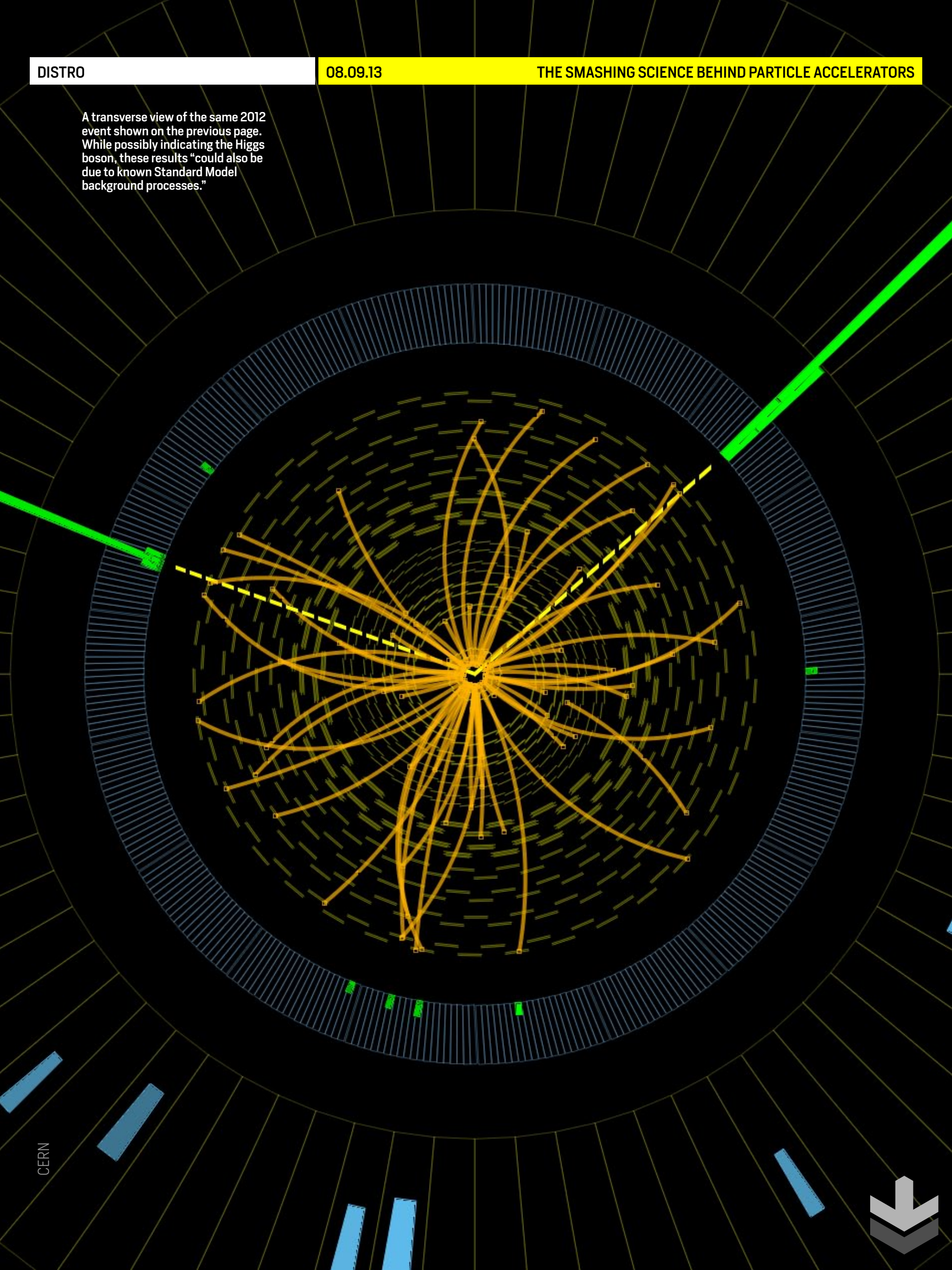
The most exciting (and vaguely anticlimactic) purpose of the LHC, however, was to find evidence of the Higgs boson. This theoretical elementary particle has no spin, electric charge or color charge, making it unique among elementary particles. It's also believed to be extremely unstable, decaying into another particle almost immediately after bursting into existence. Proof of the Higgs boson would go a long way towards confirming the existence of the Higgs field, an essential part of the Standard Model of particle physics, which has informed scientific research for much of the last 50 years. The Higgs field would explain why some particles have mass, even when other factors suggest they should be massless, and why the weak nuclear force has a much shorter range than the electromagnetic force. It would also mark an end to a 40-year search for a solution to one of the greatest unanswered questions in all of physics. The Higgs boson wouldn't lead to any immediate technological breakthroughs, but it would validate decades of scientific research and guide the search for a unified theory of everything that reconciles gravity with the other forces in nature: electromagnetic, weak and strong interactions.

In March 2013, researchers announced that the LHC detected a spinless particle that fit the Higgs boson's profile in many ways. Though the scientists were unable to say for





A transverse view of the same 2012 event shown on the previous page. While possibly indicating the Higgs boson, these results "could also be due to known Standard Model background processes."





sure that it was, in fact, a Higgs particle, they are quite confident that further study will prove that it is. The one major concern was its rather sizable mass. The problem is that, although there's still plenty of number crunching to do, we won't be any closer to confirming the existence of the Higgs boson without more experimentation. But, with the LHC offline until 2015 and the Tevatron shuttered for good, there's little hope that we'll be adding more fuel to the Standard Model fire anytime soon. The biggest shame is that there are a small handful of accelerators left performing high-energy physics research. And none can even approach the levels of energy generated at the two aforementioned colliders.

## **THE SKY IS FALLING; THE SKY IS FALLING!**

No discussion of the LHC would be complete without addressing the fear that it would destroy the Earth. A small, but vocal set of alarmists worried that by colliding particles at such high speeds, the accelerator would create microscopic black holes that would devour the Earth and all life on it. Obviously, this never happened. While the basic logic seems sound (smashing particles into an extremely small space could cause the resulting mass to collapse in on itself creating an inescapable well of infinitely dense matter), the science simply doesn't back up the apocalyptic paranoia. If, and that is a big if, the LHC could create such tiny black holes, it turns out there would be very little reason to be afraid. For one, collisions of much higher energies happen naturally in the universe all the time. As of yet, none of these collisions have led to the creation of a world-eating black hole. Additionally, black holes actually evaporate slowly through Hawking radiation. With such a low amount of mass, these micro black holes would likely evaporate very quickly.

## **NOW WHAT?**


Well, accelerator research isn't about to end anytime soon. While high-energy physics labs are going through lean times, there will always be room for research into medical imaging and synchrotron light sources, which put all that pesky X-ray radiation to use. But let's not forget, the LHC is not dead yet. The collider has only been shut down temporarily,





as researchers believe they've received the best results they can out of this particular hardware iteration. Now many of the LHC's components are undergoing a significant retrofit that should lead to higher energies and more accurate measurements. CERN tentatively scheduled its return to service for 2015 and, when it fires back up, it could possibly push 14 TeV — roughly twice its current energy levels. And a second round of proposed upgrades in 2018 will help the LHC reach even greater heights, bumping up its luminosity.

The next great leap is expected to come from a new generation of colliders, such as the International Linear Collider or the Compact Linear Collider, which are backed by competing conglomerates of scientific institutions from around the globe. These proposed linear accelerators, neither of which is far enough along to have a geographical home yet, would smash electrons into their antimatter counterpart, positrons. Since they're linear and use elementary particles, the ILC and CLIC would be capable of generating much more accurate results than the comparatively clumsy hadron colliders that have been common over the last several decades. The ILC, if approved, would stretch a minimum of 19 miles, making it not just the largest linear accelerator ever built, but also the largest particle accelerator ever. Though the total energy generated by collisions at the ILC would be lower than at the LHC, the accuracy of the data collected would be much greater. The ILC could be the key to nailing down the Higgs boson as well as potentially unlocking the existence of extra dimensions, and discovering candidates for dark matter. But, we're sure it will raise just as many questions as answers.

Have we armed you with the knowledge necessary to build your own personal proton collider? No, we probably couldn't teach you how to build a salad spinner. But hopefully the next time you spot an article about the LHC, you'll have a better appreciation for the work that goes on there. And, more importantly, you'll have to look up a few less things on Wikipedia to make sense of it. 

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*Terrence is too complicated and multifaceted to be reduced to pithy one liners. He's also kind of a jerk.*



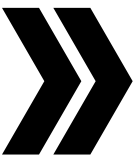
# ESOC

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08.09.13

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**SUITED FOR  
SPACE**



MARK AVINO, SMITHSONIAN INSTITUTION (SUIT); X-RAY BY ROLAND H. CUNNINGHAM AND MARK AVINO





# ESQ

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**SUITED FOR  
SPACE**

While designed for the rigors of space, these suits are apparently fickle when it comes to traveling across America. Following museum specialist Amanda Young's 2009 book *Spacesuits: The Smithsonian National Air and Space Museum Collection*, the very same institution's traveling exhibition service took to the road to share the history of its collection with the country. Built for only short periods of space extremes, the actual suits are delicate, requiring a strictly controlled environment and remain behind closed doors. But with photographs, X-ray images showing the interwoven tech, a NASA Apollo suit replica and more, the *Suited in Space* exhibit (currently at the National Air and Space Museum through December 1st) details the technology — and fashion sense — over the decades as we've reached for the stars.

MARK AVINO, SMITHSONIAN INSTITUTION (SUIT); X-RAY BY ROLAND H. CUNNINGHAM AND MARK AVINO



# BORIS SOFMAN



**THE CEO AND CO-FOUNDER, ANKI** on *Super Mario OD* and the rapid advance of app-driven devices

**What gadget do you depend on most?**  
Undoubtedly, it's my iPhone.

Whenever I have a free moment I can instantaneously become productive: respond to email, check my calendar, toy around with the Anki Drive app, etc. I'm not sure if this is a good or bad thing — always being connected to what's going on — but it certainly helps with the multi-tasking.

**Which do you look back upon most fondly?**

Original Nintendo! I loved the *Zelda* games, and of course *Super Mario*. My parents had to confiscate it from me for playing too much...

**Which company does the most to push the industry?**

For most of the past decade it was obviously Apple. Google is stepping up now and is willing to push some incredibly creative projects that are outside of their core area (autonomous car, Glass, etc.). If one of them sticks, it





## “The way ‘apps’ took over in such a short time has been remarkable.”

could have a massive impact. It’s fascinating how companies can continue to innovate and shift focus to work on such projects. It’s one of Google’s strengths and an example to companies of all sizes. I’m curious to see what happens.

### **What is your operating system of choice?**

It’s OS X these days.

### **What are your favorite gadget names?**

Some of the oldies (but goodies): Walkman, RAZR, Lego Mindstorms. Tesla Motors is an incredible name for a car company — the word “Tesla” itself naturally has a sleek, powerful connotation to it, but also has the beautiful tie-in to the historical angle. I love it when products or companies have these hidden meanings that amplify the story.

### **What are your least favorite?**

When people name products with obscure letters or numbers that don’t actually tell the customer what it is they’re buying. While I admire their products, the names of Garmin navigation devices and Dell laptops, for example, can get a bit confusing.

### **Which app do you depend on most?**

In addition to the obvious iPhone apps like Mail and Calendar, Google Maps and Yelp are my go-to apps — finding your way to great food is half the battle.

### **What traits do you most deplore in a smartphone?**

The battery always dies at the worst time... at least for me! I guess I overuse my phone. But it’s okay: I’m getting much better at carrying a charger with me at all times.

### **Which do you most admire?**

How smartphones have turned a product that was entirely hardware-focused into one entirely driven by software. And as someone who is developing on iOS, to see what people can create on the platform is pretty impressive. The way “apps” took over in such a short time has been remarkable.

### **What is your idea of the perfect device?**

One that makes you think, “How did I ever get by without this?” even if you’ve only lived with it for a few years or less.

### **What is your earliest gadget memory?**

Playing games on one of those 1980s gonzo laptops. You know, the ones that were like two inches thick with 16KB of RAM. And weighed



about 12 pounds. We thought it was pretty cool back then (as I type on my MacBook Air).

**What technological advancement do you most admire?**

There are too many to pinpoint, but some of the biggies in my book include: GPS, WiFi, the Apple App Store model and incredibly low-cost — but capable — microcontrollers and sensors. All of these core technologies have spawned an endless array of unexpected applications.

**Which do you most despise?**

Not much, I just won't use gadgets I don't like. OK, maybe 3D movies — they still feel unnatural, but I know they're here to stay so I better get used to them!

**What fault are you most tolerant of in a gadget?**

When there is limited performance in the initial versions of the gadget. If the direction they're going is incredibly novel and will obviously improve over time, then I'm willing to give it time. A prime example of this is Siri, which continues to get better and better.

**Which are you most intolerant of?**

I can't forgive an awkward interface or design. That can really make you forget about the rest of the good things.

**When has your smartphone been of the most help?**

Stranded on a broken-down Muni train in a tunnel headed into downtown San Francisco. It was the only thing keeping me sane.

**What device do you covet most?**

The Google Autonomous Car. Does that count as a gadget? Because I want it...

**If you could change one thing about your phone what would it be?**

A battery that lasts through all the abuse I put it through in the course of any given day.


**What does being connected mean to you?**

Being able to call, text, email or check something online within 10 minutes of wanting to do so.

**When are you least likely to reply to an email?**

Middle of the day. Mornings and nights are when I catch up.

**When did you last disconnect?**

During a recent Fourth of July vacation to Hawaii, but that didn't last very long. I got restless and started working halfway through. So many details to think about on the road to Anki Drive's debut this fall! 





*IN REAL LIFE* is an ongoing feature where we talk about the gadgets, apps and toys we're using in real life.

# INCIPIO FEATHER CASE FOR RETINA MACBOOK PRO

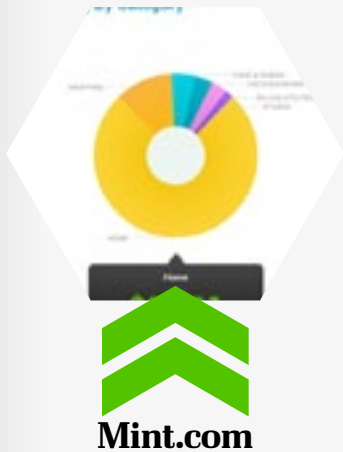
**I HAVE A FEELING JONY IVE** cringes every time an accessory maker sketches something that's meant to cover up his wonderfully designed products. But hey, no shame in trying to keep your sleek (possibly expensive) gadgets protected, right?

Here's where Incipio's snap-on Feather case has come in for me. After all, sharing the inside of a messenger bag with two cameras, a MiFi and a set of keys poses a *little* too much danger for my Retina MacBook Pro. Therefore, I decided it wouldn't be a bad idea to add some flair to my 15-inch

laptop, in order to hopefully keep it scratch- and dent-free for the long haul.

My biggest concern was adding more weight to my setup, but, thankfully, the Feather does its moniker justice: it's lightweight, as advertised, which is an enormous plus when you're spending days at a trade show. Its light weight, however, doesn't make it feel cheap; it's actually held up quite nicely in the few months I've owned it. Perhaps this is all because of what Incipio dubs high-density, ultra-light Plextonium (a fancy term for polycarbonate), or maybe the stress I put my laptop through isn't nearly as bad as I think it is. Regardless, one thing is certain: the case's durability is without a doubt of one its stronger points.

Honestly, if I had my way, I would prefer to carry around the Retina MacBook Pro au naturel, but since keeping its aluminum chassis in flawless condition is a priority, dressing it with the Feather has at least been a solid alternative. — *Edgar Alvarez*



# MINT.COM

**I'VE GOT A STUPID NUMBER** of banking apps on my phone. Chase. AmEx. Bank of America. Charles Schwab. Citi Group. If there's an institution with which I have an account of some sort, I've also got the Android app. Most of that's tucked inside my finance folder, though, which I seldom bother to go into — not unless I want to impress my parents with my ability to deposit checks from my phone anyway. Instead of all that, I've been using Mint.com, which I've connected to all said bank accounts, and then some. I use it so much in fact, that it's not in my finance folder; I can't be bothered with

that extra tap. It's even on my main home screen. That's how often I open it.

Am I obsessive? Probably. But it's just good for so many things. Sometimes I want to see if the check I gave at a wedding got cashed. Other times (read: on the 15th and 30th of the month) I peek to

make sure my paycheck has cleared. I've also gotten in the habit of checking my credit card accounts daily to make sure all the charges seem right — and if you think I'm crazy, ask about the time a car service company overcharged me by 20 bucks.

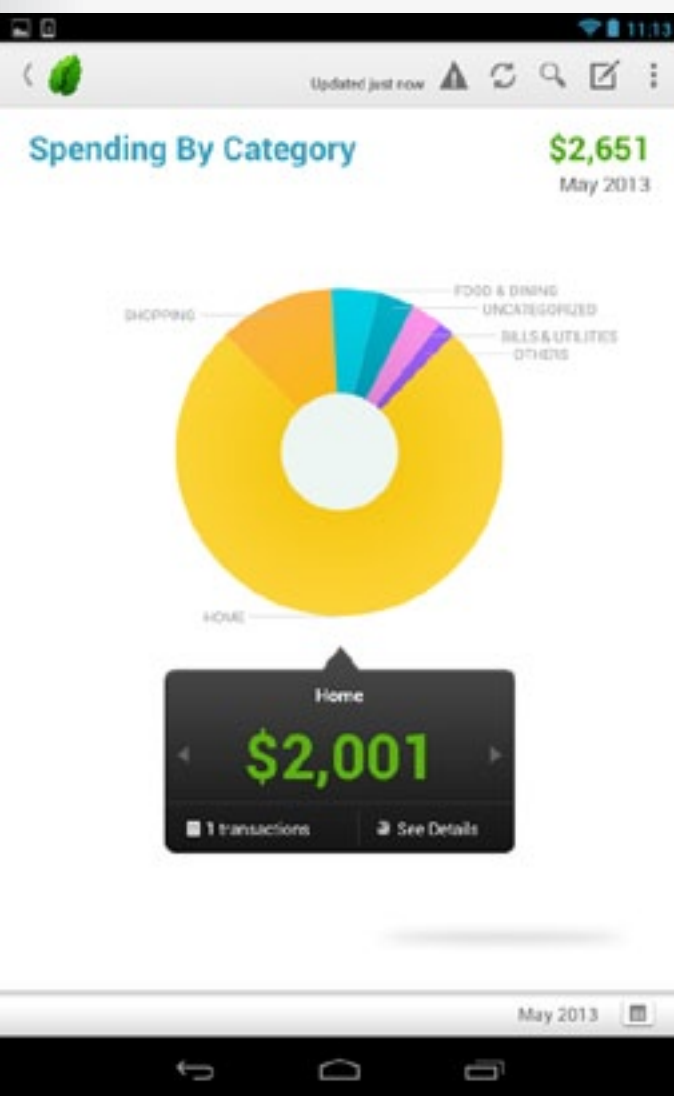
What's nice about all this is that I don't have to re-enter my bank passwords, so once I've logged into Mint itself, I can just see all my accounts at once. Also, unlike with other finance apps I've tried, like Manilla, Mint very rarely has problems connecting to my various banks. All told, just about the only thing I can't do is pay my bills from there, but fortunately, I only need to do that a few times a month.

In addition to all that, I also get a surprising amount of use out of Mint's monthly budgeting feature (I will *not* spend more than \$70 on a haircut), though it's sadly incomplete without all of my cash purchases accounted for (you could enter those items manually. Still, I'm happy enough seeing a record of how much I've taken out of the ATM). If I were *really* uptight, I'd even set savings goals, or look at charts showing where my money is going. But even obsessive-compulsives have their limits.

— Dana Wollman



Incipio  
Feather  
for Retina  
MacBook  
Pro





The week that was in 140 characters or less

# The Amazing Musk, Life is Gaga and Losing the Point

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ESC

REHASHED

@bheater

At least someone  
out there is  
still buying the  
newspaper

@ryan

No-compromise EVs, cheap space travel, hypersonic tubes. C'mon @elonmusk, quit the underachieving. I think you've got a teleporter in you.

@m4tt

I'd like to see someone mashup Lady Gaga's naked video with the LG 'Life Is Good' ringtone.

@ginatrapani

Glad Mayer is revamping Yahoo's logo, but the real upgrade would be dropping that exclamation point.

@reformedbroker

Time Warner  
Cable removes CBS  
over fee dispute,  
Americans briefly  
look up from their  
iPads, shrug.

THE STRIP

BY BOX BROWN

Box Brown has demanded an outrageous increase for comics that *Engadget Distro* delivers free via your smart device, requiring us to remove his comics from our line-up while we continue to negotiate for fair and reasonable terms.

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# TIME MACHINES

WHAT IS THIS?  
TOUCH TO FIND OUT



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TIME  
MACHINES

## SEMI-AUTOMATIC GROUND ENVIRONMENT



Many of our technological advancements are rooted in military applications and government research, and the Semi-Automatic Ground Environment (SAGE) project is a shining example. The SAGE air-defense system was born in the post-war '50s when the US Air Force tasked MIT's George Valley and the "father" of microwave radar John Marchetti with creating an early-warning radar system to monitor the US airspace perimeter for intruders. Drawing on MIT's experimental Whirlwind computer system (a vastly complex program for the time), and using dedicated telephone lines for data communication, operators at newly adopted CRT terminals monitored flight paths, communicated with Direction Centers and used "light guns" (a precursor to Douglas Engelbart's mouse) as a user interface.



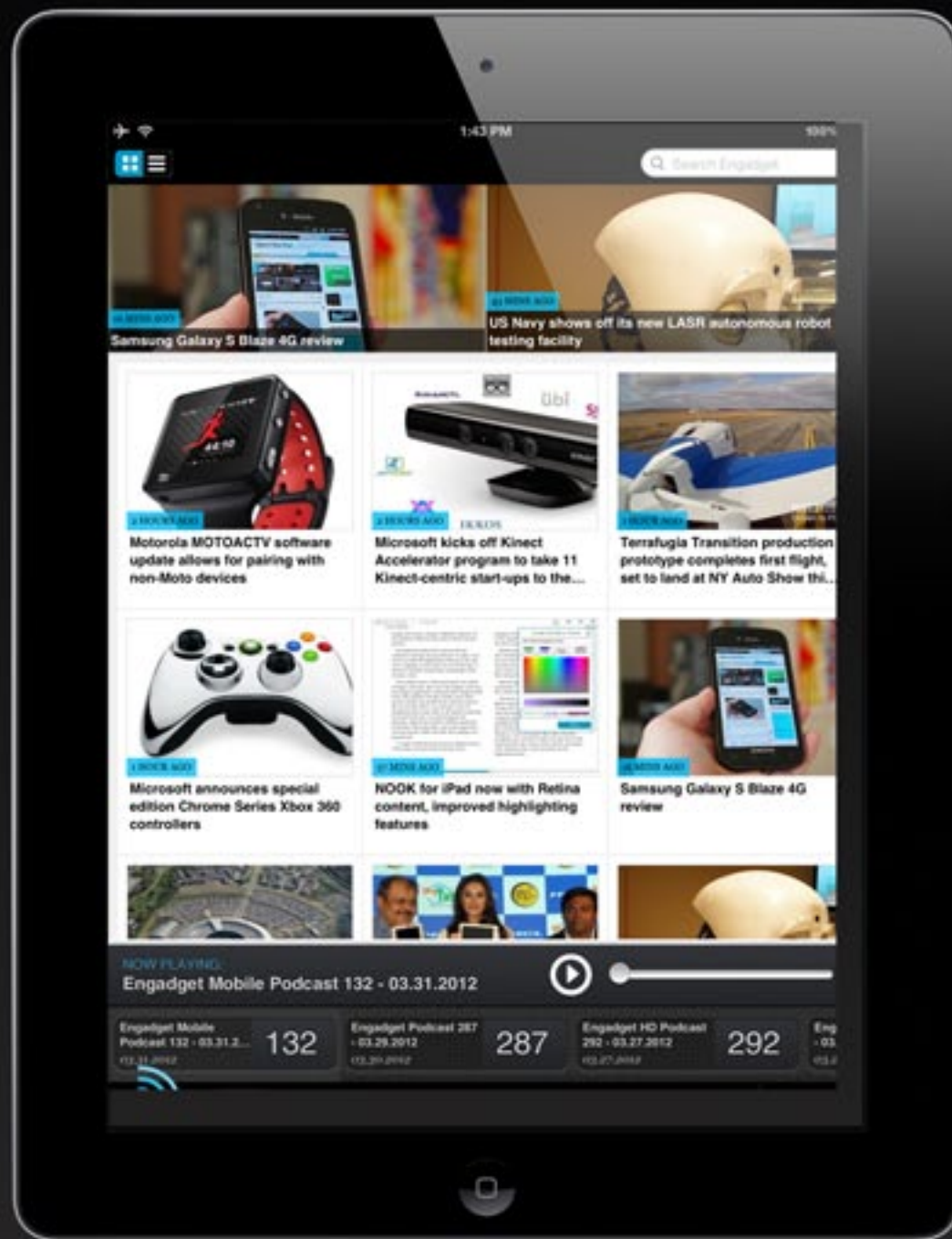
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